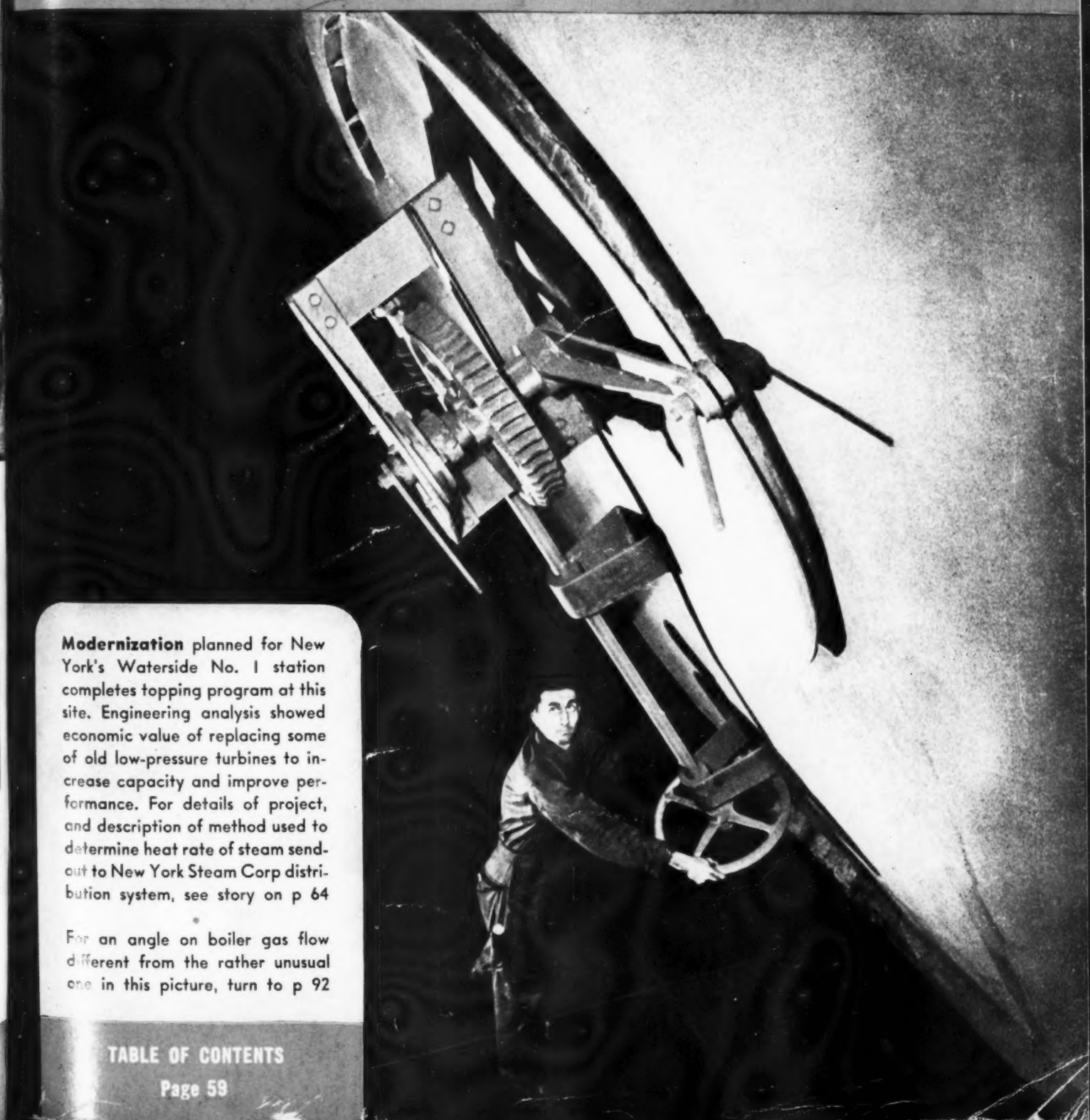
TECHNOLOGY DEPT

POWER

PUBLIC LIBRARY
AUG 1 $ 1946
DETROIT

AUGUST
1946

GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

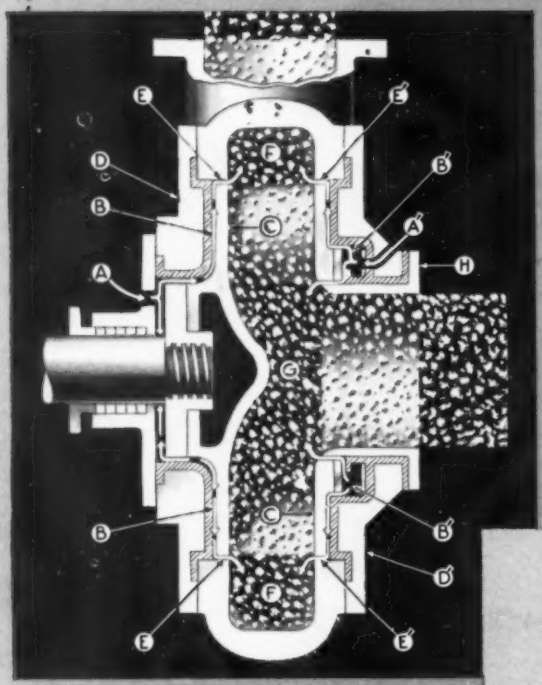


Modernization planned for New York's Waterside No. 1 station completes topping program at this site. Engineering analysis showed economic value of replacing some of old low-pressure turbines to increase capacity and improve performance. For details of project, and description of method used to determine heat rate of steam send-out to New York Steam Corp distribution system, see story on p 64

For an angle on boiler gas flow different from the rather unusual one in this picture, turn to p 92

TABLE OF CONTENTS
Page 59

HYDROSEAL PRINCIPLE AND MAXIMIX PROTECTION



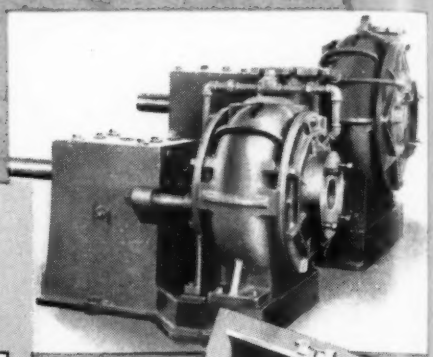
Arrows indicate hydrosealing flow and crosshatching indicates replaceable liner parts.

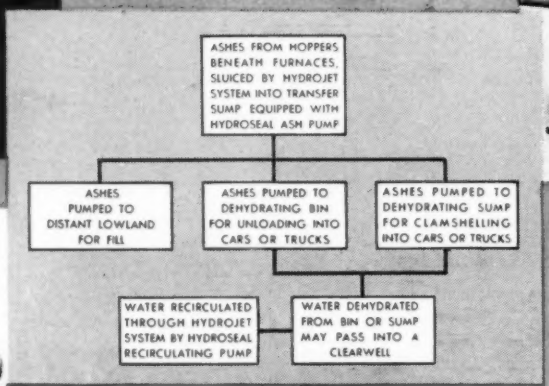
Controlled flow of small quantities of clear water or other solution free from grit is introduced at A and A'; passes through the annular clearances B and B'; between both sides of rotating impeller C and the stationary pump side plates D and D'; over the periphery E and E' entirely around each side of the impeller and into the volute F, where it mixes with abrasive-laden water. Also flowing from the annular clearance B' into the suction eye G of the impeller, entirely around the periphery of the suction sleeve H. Abrasives laden water passes through the suction sleeve H, is drawn into the impeller C, passes around the volute F, and out through the discharge. The impeller and shell are made of abrasive resistant alloys best suited for the conditions.

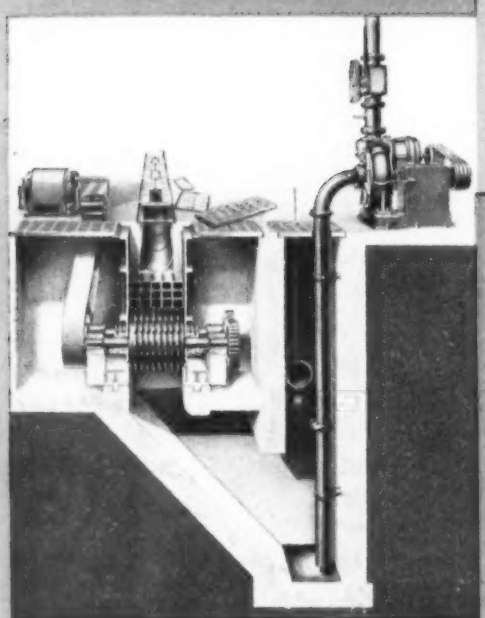
RIGHT—Hydroseal Ash Pumps.

BELOW—Flow Chart showing versatility of pumping ashes to disposal.

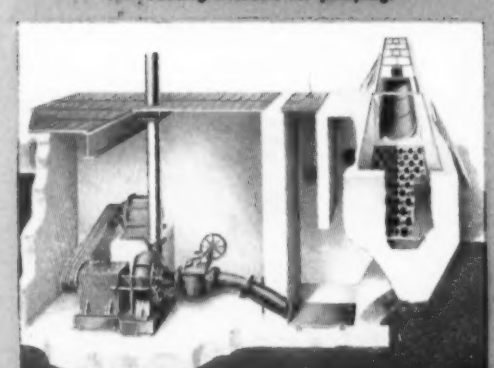
LOWER RIGHT—Methods of joining lengths of hard, abrasion resistant Ashcolite Pipe.




ASHES FROM HOPPERS BENEATH FURNACES, SLUICED BY HYDROJET SYSTEM INTO TRANSFER SUMP EQUIPPED WITH HYDROSEAL ASH PUMP
ASHES PUMPED TO DISTANT LOWLAND FOR FILL
ASHES PUMPED TO DEHYDRATING BIN FOR UNLOADING INTO CARS OR TRUCKS
ASHES PUMPED TO DEHYDRATING SUMP FOR CLAMSHELLING INTO CARS OR TRUCKS
WATER RECIRCULATED THROUGH HYDROJET SYSTEM BY HYDROSEAL RECIRCULATING PUMP
WATER DEHYDRATED FROM BIN OR SUMP MAY PASS INTO A CLEARWELL



Hydroseal Pump and Transfer Sump with Ash Grinder for reducing oversize for pumping.



Hydroseal Pump in dry well alongside Transfer Sump, so pump is always primed.

PIONEERING OUR IDEA OF "PUMP YOUR ASHES"

In the early days of the Hydrojet System, ashes were sluiced to the nearest point of disposal (fill or storage sump) and in some installations this would be quite a distance from the power plant. It soon became obvious to us and to America's leading power plant and consulting engineers who co-operated with us, that pumping offered the easiest, quickest, cleanest and cheapest means of ash disposal (see chart above). To do this with economy and reliability meant that a pump had to be designed for this severe service. The Hydroseal Pump with Maximix Rubber Bell Liners was developed by us (see description and cross section drawing above); now hundreds are used in this service, and in metal and non-metallic mines throughout the world. A special pipe was needed for handling this highly abrasive material, so we developed Ashcolite. . . . Catalogs on request; and remember *"As always, A-S-H will pioneer in ash and dust handling."*

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA 2, PA. ***Offices & Representatives in Principal Cities***

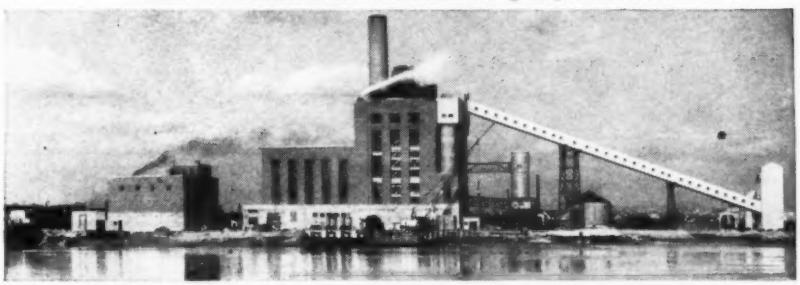
POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), August, 1946, Vol. 90, No. 8. Published monthly with an additional Directory in December, McGraw-Hill Publishing Company, Inc. Publication office, 99-129 N. Broadway, Albany 1, N. Y. Editorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Entered as second class matter August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 W. 42nd St., New York 18, N. Y. Subscription rates, U. S. and U. S. possessions, $5 for one year, $8 for two years. 50c per single copy. Canada, $6 for one year, $9 for two years. Pan American countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years.

TECHNOLOGY DEPT.

PUBLIC LIBRARY
AUG 15 1946
DETROIT

This L-B Conveyor Can Take 350 Tons of Coal "Upstairs" per Hour

The 365-ft. inclined belt conveyor which elevates the coal from the breaker-cleaner at trackside to gallery over silos.



This 100,000-Kw generating station uses a Link-Belt conveyor system with a present capacity 350 T.P.H.; ultimate 700 T.P.H.

Unloading track, transfer house, breaker house and conveyor galleries B, C, D and F.

10,401

Series of 7 Belts Handles Coal for Large Generating Stations

To move 350 tons per hour of run-of-mine bituminous coal through the various steps from railroad cars to the huge silos which feed this 100,000-Kw generating station is a real job! The L-B Belt Conveyor system as installed, supplies that quantity with a belt speed of 300 F.P.M. It can be operated up to 600 F.P.M. if ever necessary.

A. A 22-ft. cross conveyor belt takes coal from track hopper to 166-ft. inclined belt **B.**

B. This belt conveyor (see lower view) carries coal over a continuous weighing scale, discharging over a magnetic head pulley (which collects tramp iron), delivering either to belt **C** or **D.**

C. A 65-ft. stocking-out conveyor belt at right angles to centerline of **B** leads to reserve ground storage pile.

D. This 178-ft. inclined belt conveyor discharges into a breaker which reduces coal to proper size and takes out non-magnetic objects.

E. A short, inclined belt receives coal from breaker-cleaner and delivers it to the inclined belt conveyor **F** shown in top view.

F. This 365-ft. link in the system takes the coal to a conveyor gallery over the six 250-ton silos. A side view of conveyor **F** appears in center picture.

H. A shuttle belt conveyor mounted on movable steel frame, may be motor propelled over all six silos. Coal from belt **F** is thus delivered to silos, from which it goes to pulverizer and thence to furnace.

Whatever type of conveyor is indicated for your situation, Link-Belt engineers can give you a practical, economical solution.

LINK-BELT

THE SYMBOL OF QUALITY L-B LINK-BELT

BELT CONVEYOR EQUIPMENT

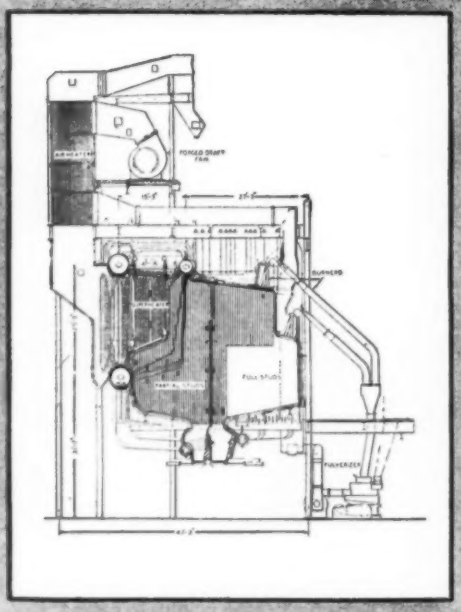
IDLERS • TRIPPERS • BELTS • PULLEYS • BEARINGS • DRIVES

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

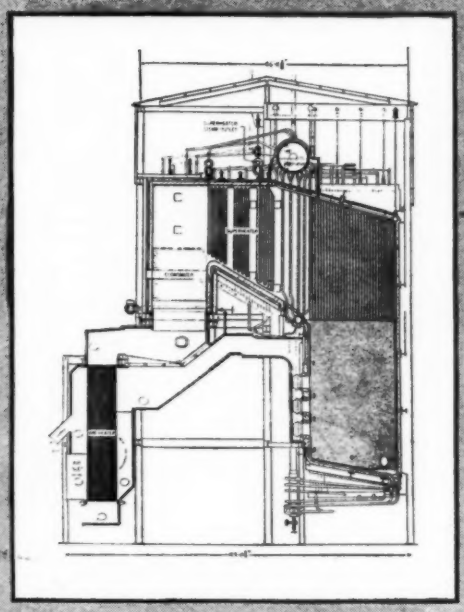
PUBLIC LIBRARY

ANY TEMPERATURE . . . ANY PRESSURE . . .

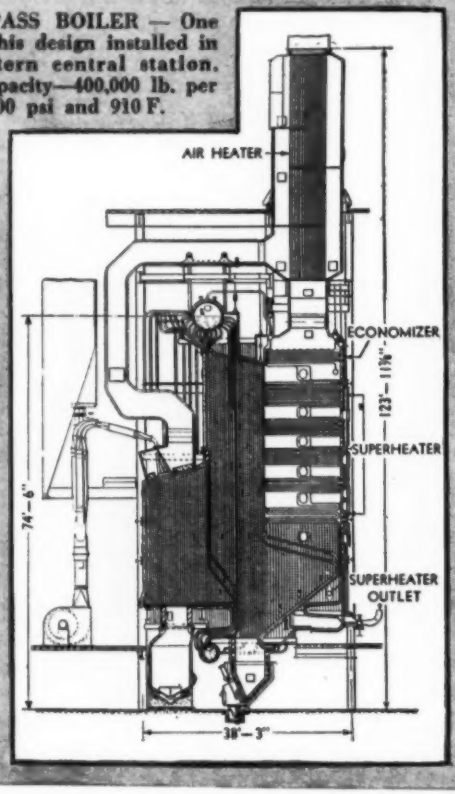


STIRLING BOILER—Four units of this special design installed in mid-western central station. Steam capacity each—350,000 lb. per hr. at 925 psi and 900 F.

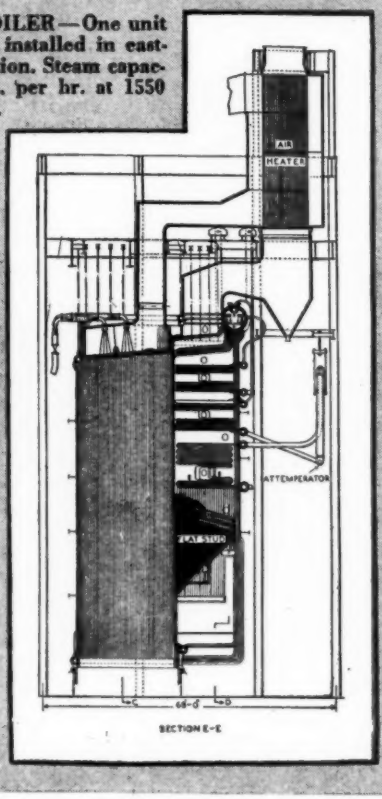
RADIANT BOILER—Twelve units of this design installed in Pacific Coast central stations. Steam capacity each—200,000 lb. per hr. at 1525 psi and 950 F.



OPEN-PASS BOILER — One unit of this design installed in mid-western central station. Steam capacity—400,000 lb. per hr. at 1500 psi and 910 F.

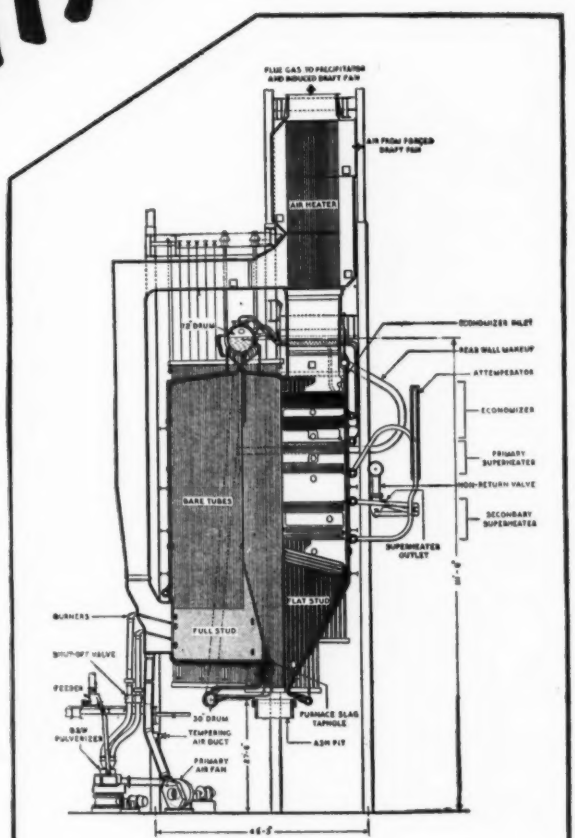


RADIANT BOILER—One unit of this design installed in eastern central station. Steam capacity—800,000 lb. per hr. at 1550 psi and 925 F.



ANY STEAM CAPACITY with B&W Boiler Designs

HIGHEST standards of performance with respect to continuity of service, dependability, over-all operating efficiency, and greatest return on investment, are assured when any job of supplying steam requirements for electric power generation is entrusted to B&W Boilers. From the time-tested, performance-proved B&W boiler designs — Open Pass, Radiant, High Head, Stirling and Integral-Furnace — you can always be sure of getting units having features necessary to provide economical steam generation under any combination of pressure, temperature, fuel and space requirements consistent with modern boiler applications. When you call on B&W for boilers and related equipment you call on a background of over 60 years' unsurpassed experience in designing and building steam generating units that have achieved a long record of highly satisfactory service in public utility stations in all sections of the United States. Among the recent installations of B&W boilers in this field are the designs shown on these pages.



OPEN-PASS BOILER — Two units of this design installed in eastern central station. Steam capacity each—975,000 lb. per hr. at 1100 psi and 950 F.

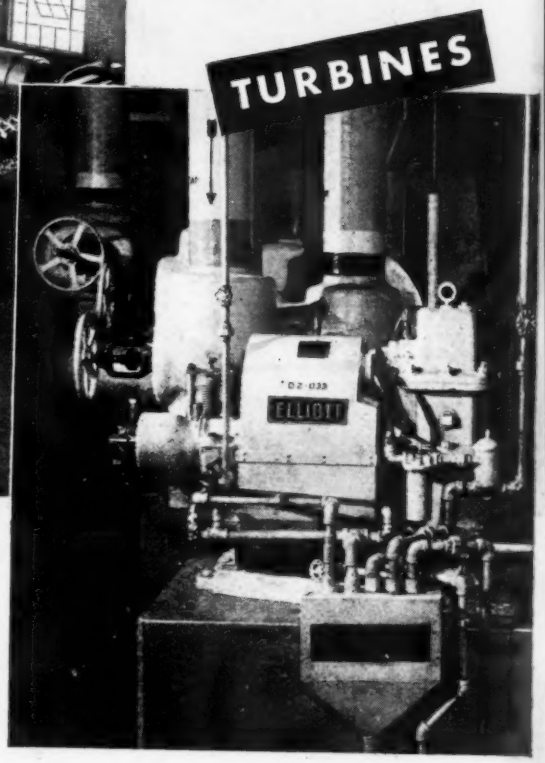
Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

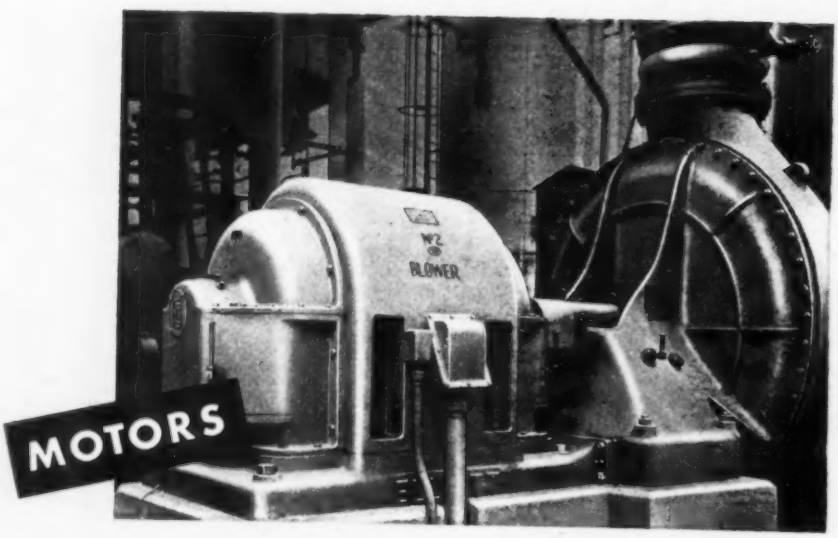
BABCOCK & WILCOX

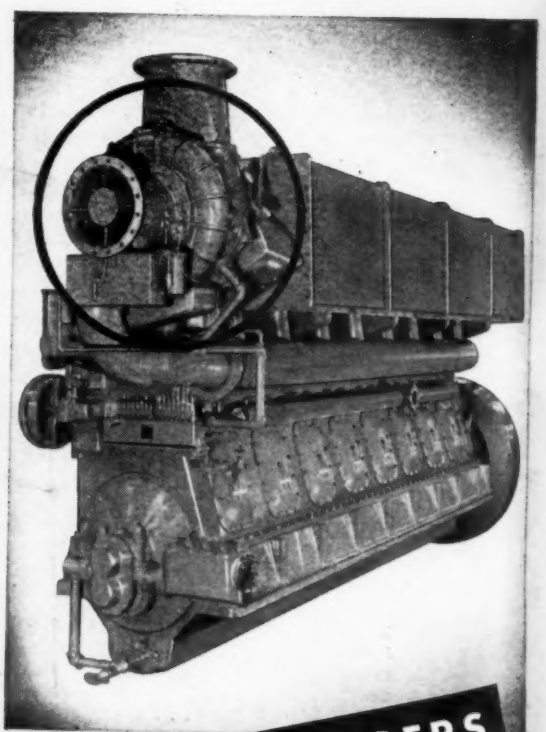
THE BABCOCK & WILCOX CO.
85 LIBERTY STREET, NEW YORK 6, N.Y.

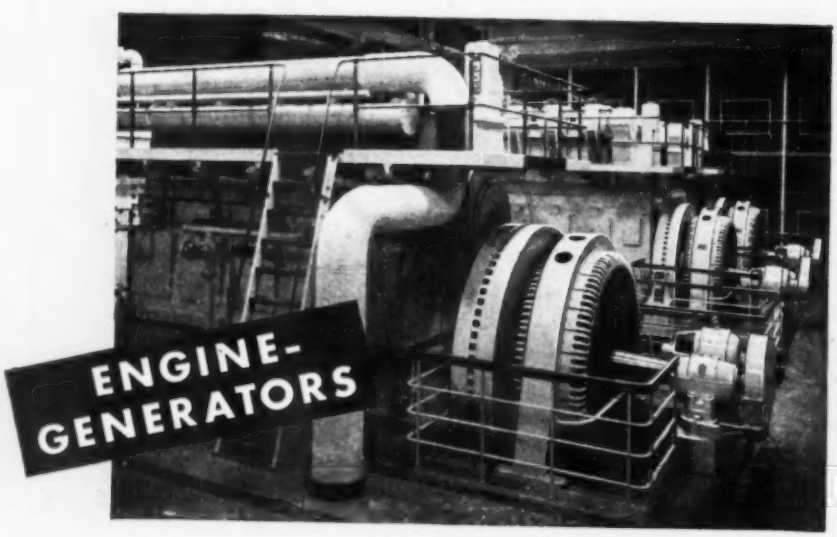
G-316T

A signature that's good





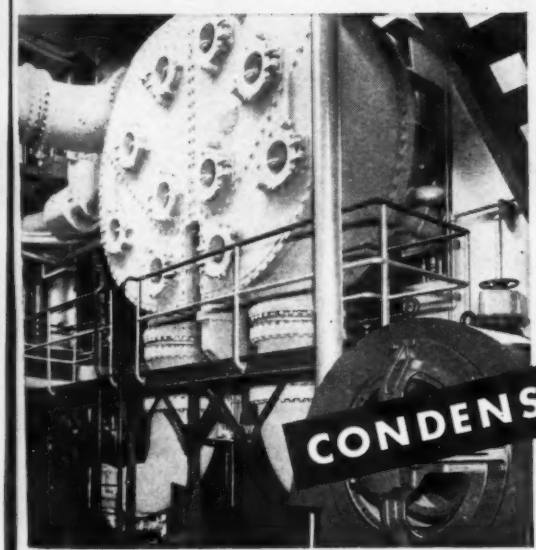




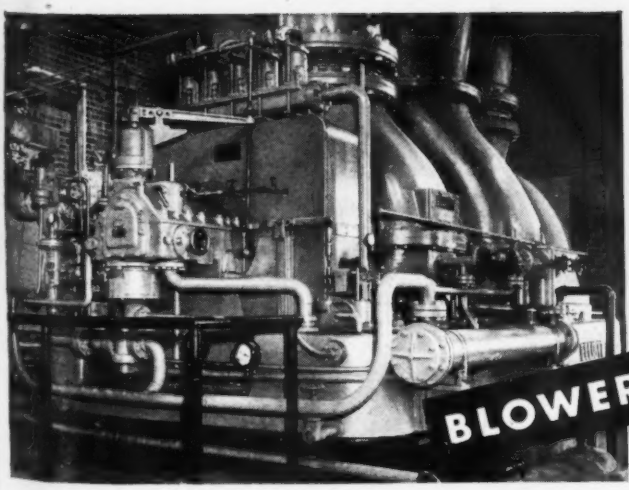
d everywhere

ELLIOTT

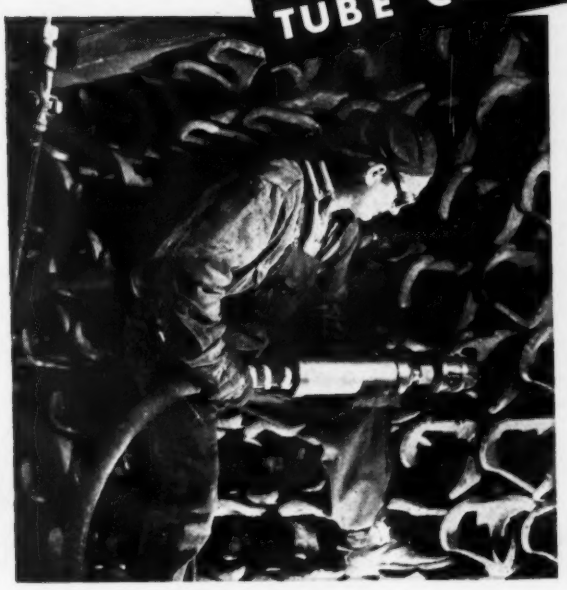
DEAERATING HEATERS



CONDENSERS



BLOWERS



TUBE CLEANERS

On any piece of power or process equipment the name **ELLIOTT** is a guarantee of performance that you can count on — assurance of constancy in operation, of closely predictable costs, and of the solid human satisfaction every engineer feels with a piece of equipment that's doing its job.

Besides the products illustrated, Elliott makes: Steam Jet Ejectors—Strainers—Grease Extractors — Desuperheaters — Separators—Automatic Valves.

Bulletins at request.

ELLIOTT COMPANY

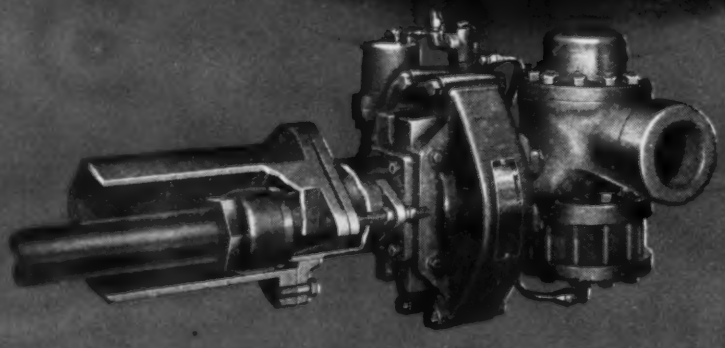
JEANNETTE, PA. • RIDGWAY, PA. • SPRINGFIELD, O. • NEWARK, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

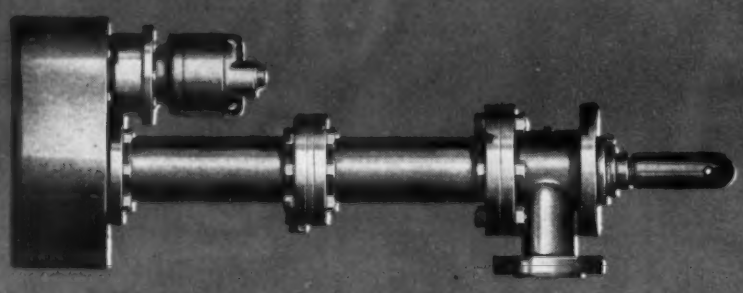
Q-1124

CLEANER BOILERS

With DIAMOND *Automatic Sequential* AIR SOOT BLOWERS



Diamond "Air Puff" Soot Blower having element permanently installed inside the setting. Compressed air is discharged in a series of short puffs with substantial pauses between. Spreading cleaning cycle over longer period of time permits use of much smaller compressor and eliminates stack discharge nuisance.



Diamond Model IF Short Retracting Soot Blower for cleaning either furnace walls or boiler heating surfaces (by change in nozzle design) where gas temperatures exceed the limit for units permanently installed inside the setting.

DIAMOND POWER SPECIALTY CORP.

Detroit 31, Michigan

DIAMOND SPECIALTY LTD. • Windsor, Ontario

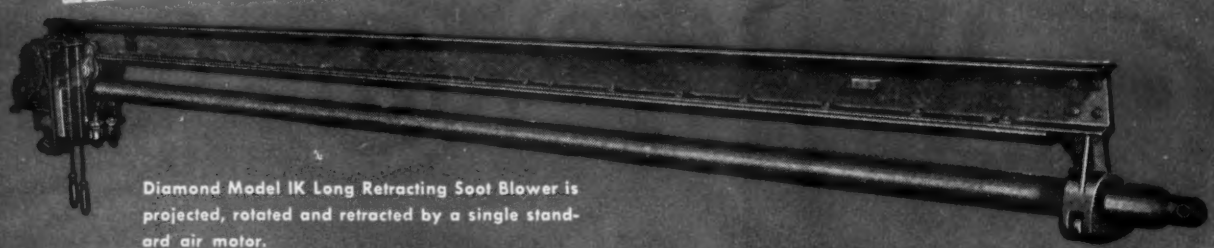
AT LOWER SOOT BLOWING COSTS

When the "Start" control of a Diamond Automatic Sequential Air Soot Blower System is pushed, the program panel takes over. Each blower is operated at exactly the right blowing speed . . . and in the correct sequence. No blower can be skipped or given the quick "once over" which hand-operated blowers often get. Also, compressed air has a greater density than steam and therefore is a better cleaning medium. The combined result is much more effective boiler cleaning.

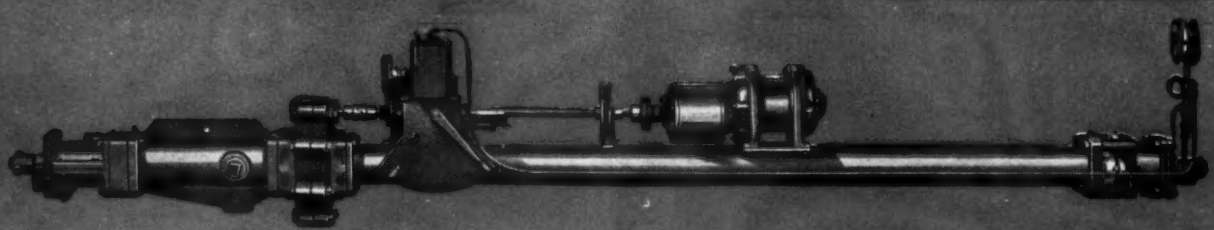
Automatic operation saves considerable labor cost because it entirely eliminates the need for an operator. Using compressed air makes an additional saving by eliminating feed water makeup. Five years' operating experience has proved maintenance costs are unusually low and that air cleaning uses only ⅓ to ⅔ of the energy from the coal pile that is needed for steam blowing.

Automatic Sequential Air Soot Blower Systems of Diamond design and manufacture have been in successful operation on large central station boilers since 1940.

This program panel controls both fixed and retracting blowers arranged in three groups. Panel can be arranged for any number of groups when system is designed.



Diamond Model IK Long Retracting Soot Blower is projected, rotated and retracted by a single standard air motor.



Diamond "Telescopic" Soot Blower is used where clear space outside the boiler is insufficient for the Model IK Blower. Electric drive shown but air drive also available.

AIR AS A CLEANING MEDIUM

- SAVES FEED WATER MAKEUP
- SAVES LABOR
- SAVES MAINTENANCE
- SAVES FUEL
- SAVES PIPING INSULATION

Here are the benefits you get from

BAILEY CONTROLS

1. Fuel Conservation without decrease in output.

2. Lower Cost Steam.

3. Increased Safety for Plant and Personnel.

4. Better Power Service.

Bailey Controls for boilers make the important factors of steam plant operation work together to insure ideal performance.

In order that all of these factors may be regulated in harmony with each other and the load demand, Bailey Controls are carefully engineered to the requirements of the units which they serve.

Bailey engineering service starts with the selection of suitable metering and control equipment and continues through the design, construction, calibration, installation and final adjustment on the job. Bailey field engineers are stationed in over thirty industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense.

The Bailey engineer in your community has extensive experience at his command, which includes tests on thousands of boiler installations, covering a wide range of fuels, furnaces and fuel burning equipment. He is in a position to help you secure the many benefits resulting from intelligent use of correctly selected and properly applied boiler control.

Bailey Controls for boiler operation are described in Bulletin 15-C. Write for your copy to Bailey Meter Company, 1036 Ivanhoe Road, Cleveland 10, Ohio —in Canada to Bailey Meter Company Limited, Montreal.

FUEL CONVERSION

If it becomes desirable or necessary to convert to another fuel, Bailey Controls can be adjusted easily to insure optimum results from the new fuel.

G-26

BAILEY METER COMPANY

1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Controls for Steam Plants

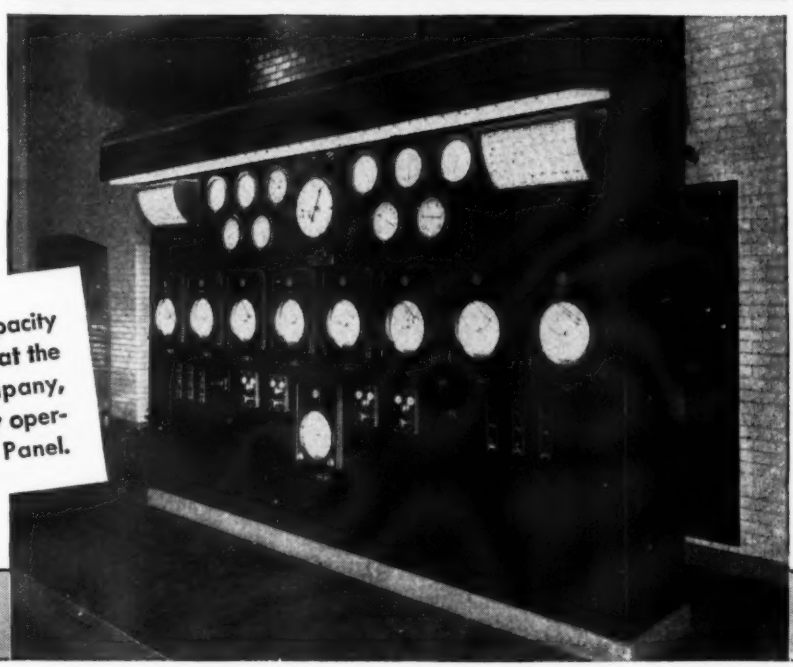
APPLICATION to STOKER FIRED BOILERS

UNDERFEED

This Bailey Control Panel insures optimum performance from three underfeed stokers on two 25,000 and one 40,000 lb. per hour capacity boilers at Parker Appliance Company, Cleveland, Ohio.

SPREADER

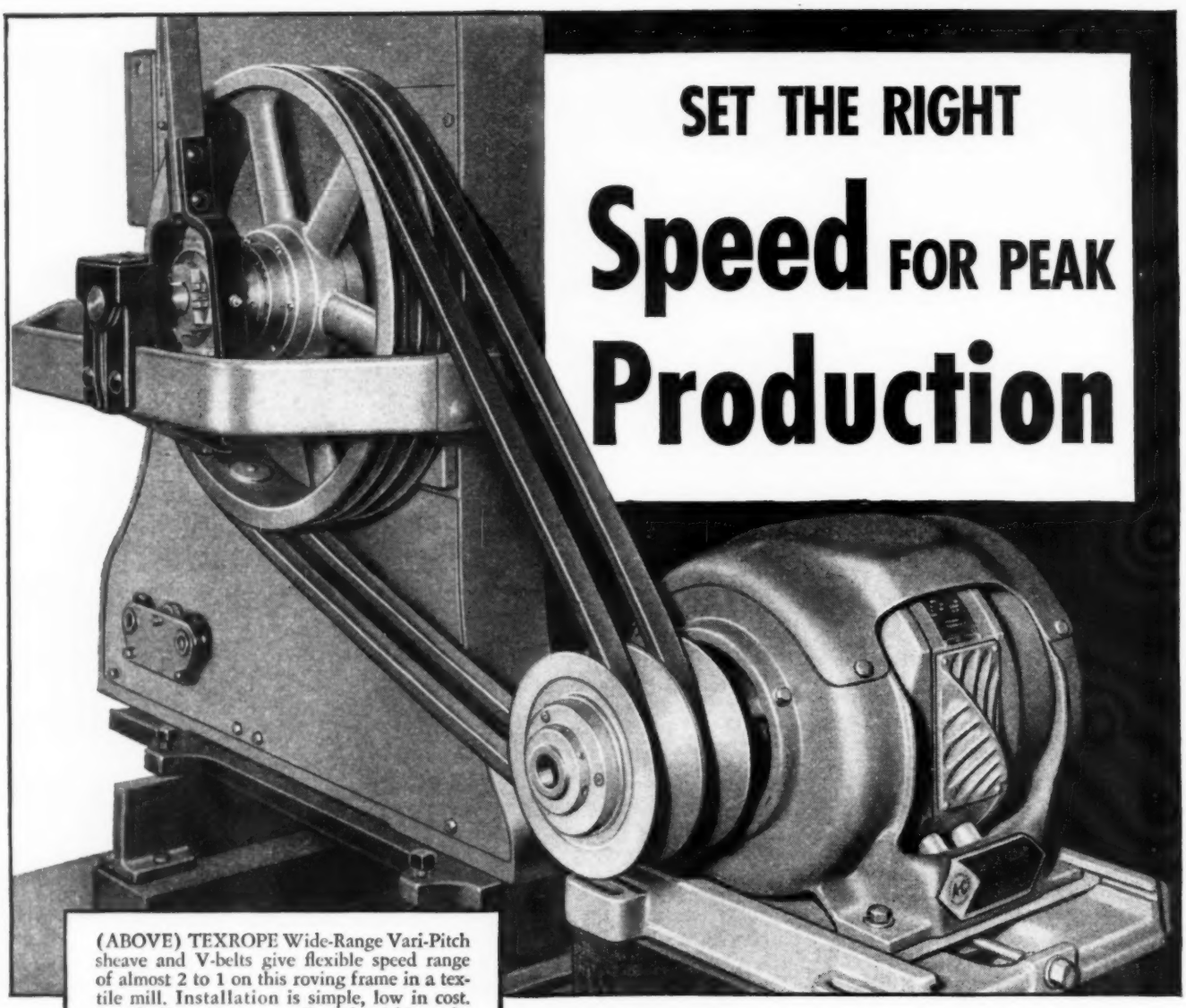
Bailey Controls help operators at Graham-Paige Motors Corporation, Detroit, Michigan, to maintain tests standards in everyday operation of this 60,000 lb. per hour boiler fired by a spreader type stoker.



CHAIN GRATE

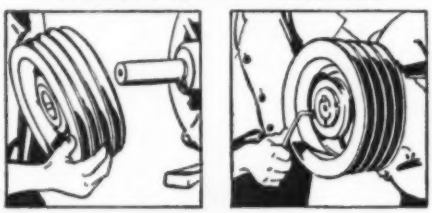
Two 40,000 lb. per hour capacity chain grate stoker fired boilers at the United States Tobacco Company, Chicago, Illinois, are efficiently operated by this Bailey Control Panel.

SET THE RIGHT Speed FOR PEAK Production



(ABOVE) TEXROPE Wide-Range Vari-Pitch sheave and V-belts give flexible speed range of almost 2 to 1 on this roving frame in a textile mill. Installation is simple, low in cost. Speed adjustments are easily and quickly made.

"MAGIC-GRIP" SHEAVE



GOES ON EASY . . . GRIPS TIGHT

Patented "Magic-Grip" sheave comes completely assembled. You simply slip it on the shaft (there's easy clearance for even over-size shafts) then tighten three cap screws. Sheave is locked on with a powerful clamp fit — yet it can be removed just as easily. No hammering to damage motor bearings — no filing or reaming. And, no wobble, weave or backlash.

TEXROPE Variable-Speed Drives Give Speed Flexibility at Low Cost

ON MILLS, machine tools, blowers, pumps — wherever changes in speed will add to operating efficiency, output or economy — get the speed flexibility you need with low-cost constant-speed motors and Texrope Variable Speed Drives. There are types to meet all requirements: Vari-Pitch sheaves, for stationary and motion control, Wide-Range Vari-Pitch drives and Speed-Changers.

COMPLETE V-BELT SERVICE: Your Allis-Chalmers dealer or district office offers TEXROPE "Super-7" V-Belts in five types, all lengths and sections; TEXSTEEL, TEXDRIVE and "Magic-Grip" Sheaves. It's a COMPLETE line of V-Belt equipment, engineered by Allis-Chalmers, originator of the multiple V-Belt Drive. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 2084

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

TEXROPE V-BELT DRIVES

Let's look at the RECORD

. . . to forecast your BOILER FUTURE

The record shows Foster Wheeler boilers supplying steam power to manufacture the familiar goods of everyday life, intermediate raw materials, electric power for industry and homes. In the development of American industries, Foster Wheeler has contributed better methods and equipment for specific needs. Today Foster Wheeler boilers are supplying steam power for manufacturers who represent every phase of the nation's industrial life. To name a few, there are manufacturers of . . .

Steel

Automobiles

Electric Power

Roller Bearings

Petroleum Products

Chemical Preparations

Paper and Paper Products

In any consideration of your future boiler requirements, Foster Wheeler's vast backlog of pioneer engineering experience is available to meet—and anticipate—new problems. Special service conditions, unknown today, will dictate your future boiler requirements. Engineering to fulfill these special service conditions will be Foster Wheeler's contribution at that time, as it has been in the past.

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

The Trend is to...

REPUBLIC REGULATOR APPLICATIONS

Pressure Control

Steam pressure control
Boiler furnace draft
Primary air pressure
Feed water pressure
Evaporator pressure
Process steam pressure
Blast air pressure
Exhauster suction
Fuel gas pressure
Suction main pressure
Excess pressure

Flow Control

Water flow to desuperheaters
Water flow to condensers
Oil flow to boilers and furnaces
Gas flow to boilers and furnaces
Air flow to gas producers
Pump bypass

Level Control

Hot well levels
Surge tank levels
Storage tank levels
Evaporator levels
Boiler water levels

Speed Control

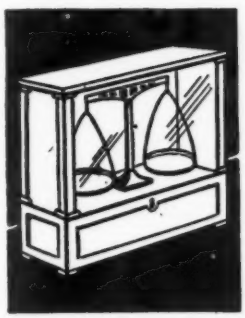
Stoker and fuel feeder speeds
Pulverizer speed
Pump speed
Fan speed
Steam turbine speed
Steam engine speed
Variable speed motors
Variable speed transmissions

View of a Republic hydraulic type regulator for controlling boiler air flow, mounted on stand with power cylinder.

REPUBLIC
INSTRUMENTS
AND CONTROLS

REPUBLIC Regulators

Because They Meet These Four Essentials of Good Regulation



Republic Regulators can be made sensitive to changes of less than 0.002 of an inch of water.

SENSITIVITY

The amount of change that is required in the quantity being controlled to effect the regulator is the measure of its sensitivity. For close, accurate regulation, a regulator must be sensitive. It must respond immediately to the slightest deviation from the predetermined setting or the controlled quantity may vary far beyond the permissible limits.

Republic Regulators will meet any speed requirement up to one full stroke in 2 seconds.

SPEED

The speed at which a regulator operates is an important factor in any control system. Any time lag between the variations in the controlled quantity and the operation of the control device to correct this variation, will produce an unnecessary error in regulation. A regulator, therefore, must be fast enough to follow the fastest load fluctuation.

Republic power cylinders are available to meet the specific power requirements of any particular installation.

POWER

A regulator must have sufficient power to not only operate the valve or other control device, but also to overcome any accidental friction or sticking that may occur in any part of the system. Insufficient power will cause failure in operation. It is for this reason that regulators are made with different size power cylinders, the smaller sizes being used for small valves and the larger sizes for the larger dampers and louvers.

The Republic stabilizer will stabilize against any time lag in the operation of the equipment being controlled.

STABILITY

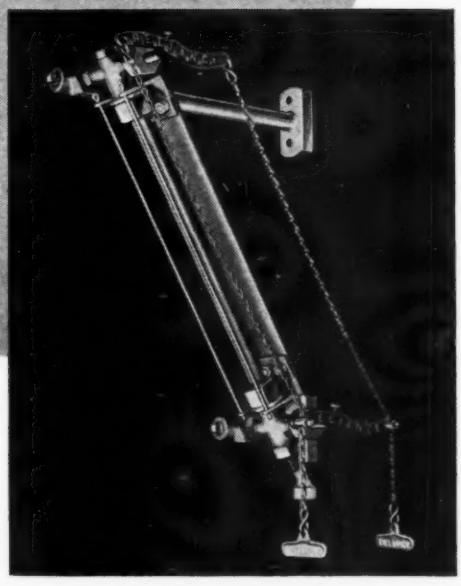
Stability refers to the ability of a regulator to maintain its balanced position or to return immediately to a balanced position if the controlled quantity is disturbed. There is always an interval between the time the valve or other control device is moved and the time the controlled quantity changes in response to this movement. Unless a regulator is stabilized it will tend to "hunt" or overtravel causing unnecessary variations.

Write for Data Book No. S-13

Republic Flow Meters Co.

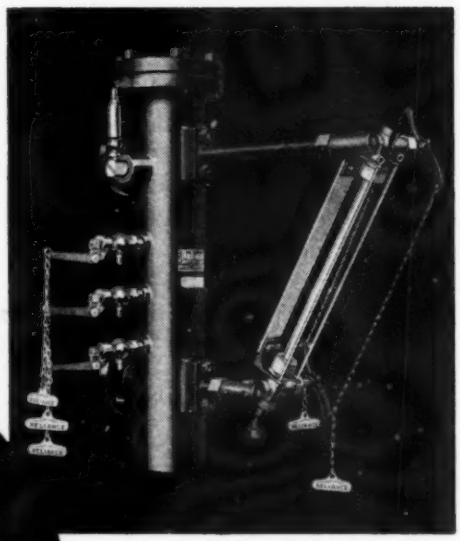
2222 Diversey Parkway • Chicago 47, Illinois

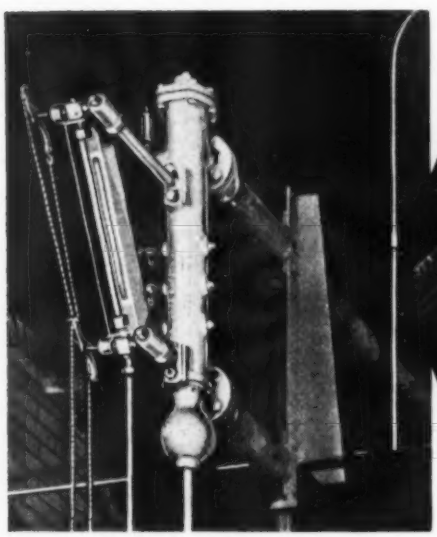
TILT your high water gages *FORWARD* for easier visibility— safer operation—with Reliance *TILTVIEW* Gage



● Are your boiler water gages high above the floor? Or is your front-of-boiler space narrow, making gage reading almost a "straight up" job? One of your best solutions for these problems is the *TILTVIEW* Gage — the sturdy Reliance assembly that tilts gage glass or insert 30 degrees forward — gives your engineers a chance to get an accurate reading without guesswork and without climbing.

TILTVIEW is made of high grade materials; assembled at factory with valves for pressures to 250 lbs., or to 450 lbs.; screwed or flanged mounting connections. Rigid alignment maintained by steel tie-plate in enamel finish — serves also as a reflector. Write for Bulletin 418 or call nearest Reliance Representative.





Reliance
Boiler Safety Devices

•

ALARM Water Columns

PRISMATIC Gage Inserts

Mica-protected Flat Glass Gage Inserts

Gage Valves • Gage Cocks

EYE-HYE Remote Reading Liquid Level Indicator

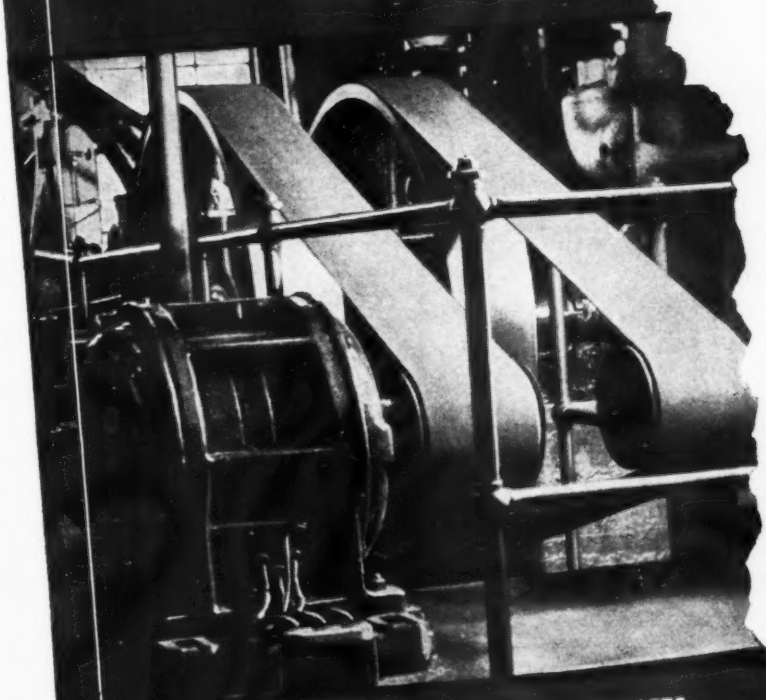
BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

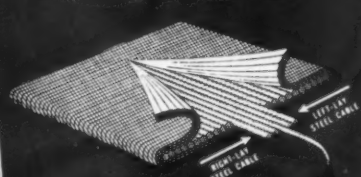
Tames "KILLER" DRIVES

—because it's sinewed with steel



GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM-Specified COMPASS 250 STEEL CABLE TRANSMISSION BELT for Heavy-Duty Drives



The Goodyear COMPASS 250 Steel Cable Transmission Belt is bodied with multi-strand airplane-type cable, spiraled continuously without a splice. Cable on opposing sides of belt axis is twisted in opposite directions to insure true running.

IF you've got a drive that's a killer —a drive that quickly wears out even extra-tough belts—you can tame it with Goodyear's COMPASS 250 Steel Cable Belts. They have power-load capacity up to 37 horsepower *per inch of width!* TWICE the horsepower rating, width for width, of the best belts heretofore available!

That's because they're sinewed with endless, multiple-strand steel cables, embedded in the very highest quality rubber. As a result, COMPASS 250 belts can handle far heavier loads, withstand much higher tensions—thus making possible more compact drives with smaller belts and pulleys. COMPASS 250 is truly *stretchless.* Once fitted to a drive it seldom if ever requires take-up, and creep is negligible. It is far more flexible than any plied-up fabric-bonded belt and has far longer life expectancy.

You'll want all of the details on COMPASS 250 belts—facts and figures on the way they can increase operating efficiency while they lower maintenance costs. To get them, phone the G.T.M.—Goodyear Technical Man—or your nearest distributor of Goodyear Industrial Rubber Products.

• • •

FOR HOSE, BELTING, PACKING, MOLDED RUBBER GOODS built to the world's highest quality standard, phone your nearest Goodyear Industrial Rubber Products Distributor.

Compass—T.M. The Goodyear Tire & Rubber Company

GOODYEAR

THE GREATEST NAME IN RUBBER

SPOTTING TROUBLE

to prevent TROUBLE SPOTS

Magnaflux inspection of Sivyer Castings is just one of the many tests available to Sivyer metallurgists and engineers. Together they mean more exacting control of Sivyer quality: steel castings that measure up to requirements in every way . . . that do a better job, longer.

You can have castings of greater integrity of metal . . . of greater dimensional accuracy . . . of better finishing when you specify Sivyer.

Ask for full details of Sivyer's complete steel casting service.

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

SIVYER STEEL CASTINGS

IT IS TRUE that the Perfect Spread Stoker has a 17-year record of *proved* performance and economy in 15 types of industries. It is also true that recent redesigning has greatly improved and simplified its operation. Here, now, is a vigorous employee that will work 'round-the-clock for you—producing more steam *automatically* at lower cost than you believed possible.

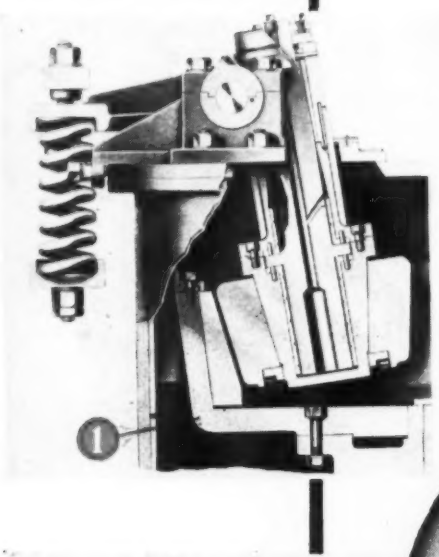
Feed this stoker the lowest available grades of coal and other solid fuels—wet, dry or partially frozen. Defy it to clog or fail or to let you down when steam is needed most. Then watch it continue spreading a "perfect" fuel bed at infinitely variable rates of speed by the dependable *overthrow* method. Hear how quiet it is, see how easy to operate, and how accessible are all parts—because they're protected by functional streamlining. Most important, watch this new addition to your boiler room staff quickly pay for itself out of fuel and maintenance savings. Please write and ask for the Æ Perfect Spread Stoker booklet.

Æ PERFECT SPREAD STOKER
With stationary grates, dumping grates or continuous ash discharge—up to 400,000 lbs. of steam per hr.
WON'T CLOG ON Wet COAL!
Forget your wet coal problems! Get steady, reliable fuel firing with the stoker that thrives on wet or partially frozen coal—that has the exclusive Æ non-clog feature!
OTHER Æ PRODUCTS: Æ-TAYLOR STOKERS, LO-HED HOISTS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER.

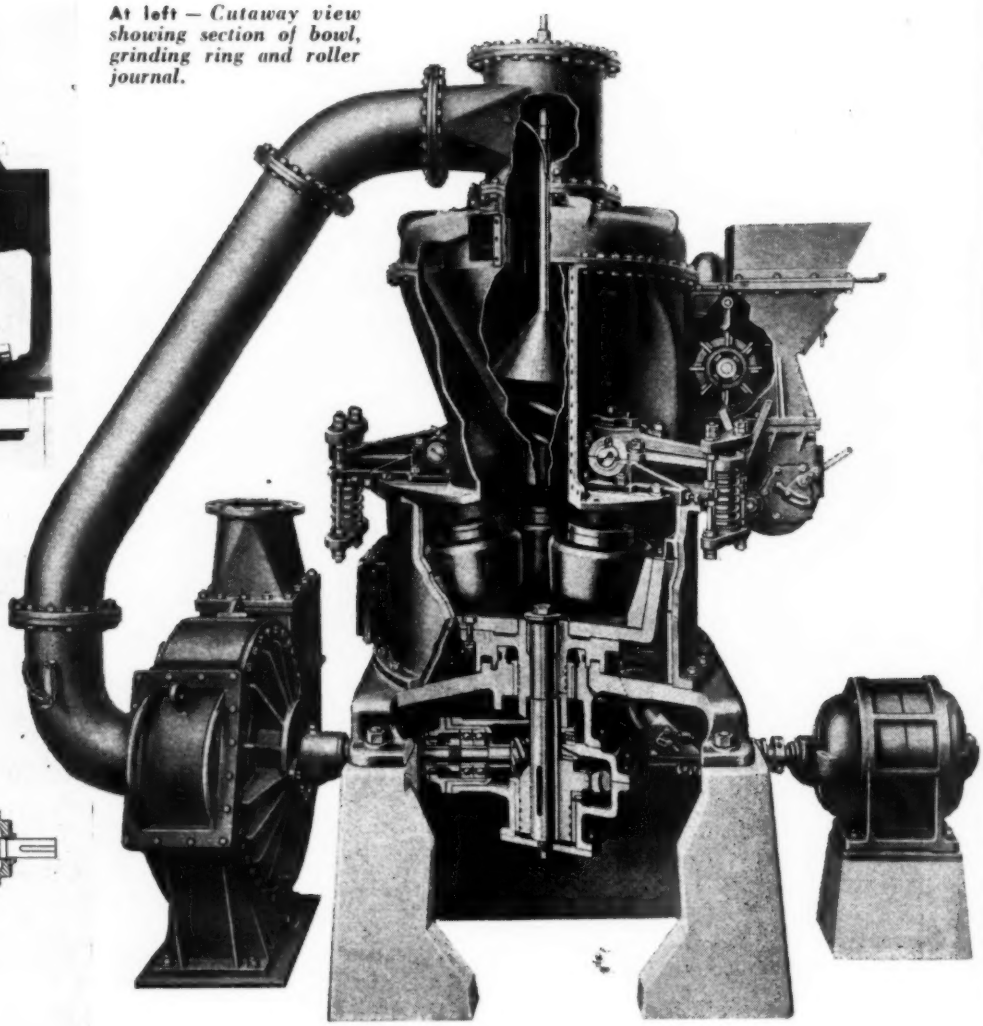
AMERICAN ENGINEERING COMPANY

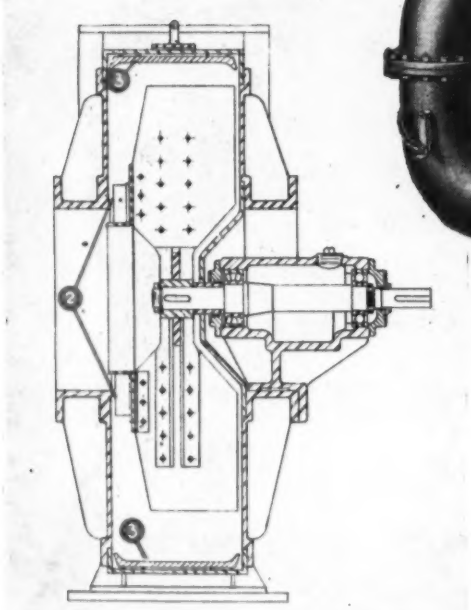
2400 ARAMINGO AVE., PHILADELPHIA 25, PENNSYLVANIA

C-E RAYMOND



At left — *Cutaway view showing section of bowl, grinding ring and roller journal.*





At left — *Section through mill exhauster showing new shrouded fan wheel with "whizzer" blades.*

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

BOWL MILL...

now better than ever

In 1935 the C-E Raymond Bowl Mill came into the steam-power field with design and operating advantages that revolutionized previous concepts of coal pulverization. It had a wide capacity range. It handled wet coal with great facility. It was rugged, accessible and easily maintained. The mill ran quietly and power consumption was low. In consequence, the Bowl Mill won immediate and widespread acceptance among plant engineers — more than a million lb pr hr of grinding capacity was ordered within five years.

Today, the Bowl Mill with all of its initial advantages, offers several new improvements, among which the following are of major importance:

1. Flat-Bottom Bowl — increases the response of the mill to load changes by eliminating any inactive area where coal can remain in the mill; also avoids any tendency of heavy, abrasive material such as pyrites, to accumulate in the bottom of the bowl.

2. The Whizzer Wheel — a new exhauster wheel design which greatly increases the life of exhauster blades. A shrouded wheel carries heavily constructed "whizzer" blades which bypass a portion of the air-coal mixture directly to the exhauster outlet. In service this has doubled the life of exhauster blades — in some cases more than doubled it.

3. New, Wear-Resisting Materials — are now being used for exhauster liners and deflectors, resulting in greatly increased life of these parts.

4. Center Feed — where conditions permit, larger Bowl Mills can now be arranged for center feed which assures a freer flow of coal to the mill and serves to equalize wear on grinding parts.

Thus 1946 finds the C-E Raymond Bowl Mill, after more than 10 years at the top of its field, still adding refinements in design and materials that make it better than ever before.

40% of all Bowl Mills purchased to date are *Repeat* orders

C-E

A-977

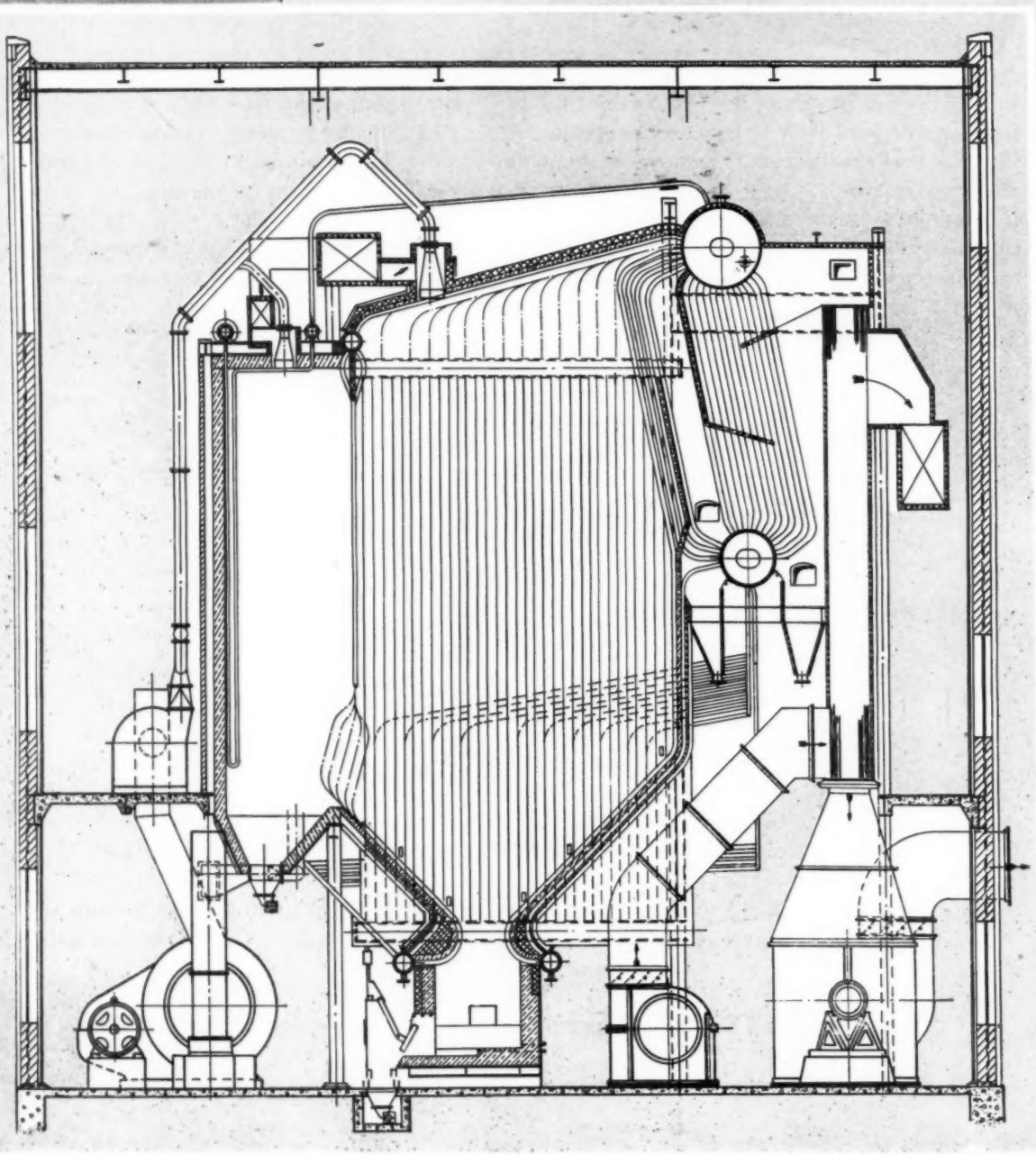
ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

KVS

ENGINEERING

anticipates tomorrow's needs



for ECONOMY... HIGH EFFICIENCY AND ... LOW MAINTENANCE

Modern features of this complete, pulverized coal-fired steam-generating unit have been engineered by KVS to achieve over-all high efficiency on a wide range of coals and to assure close temperature control under practically all load conditions.

Accurate control of superheat and total steam temperature is provided by locating the superheater in a separate furnace fired by an individual burner. Varying heat output of this burner places in the operator's hands effective means of regulating steam temperature at any steam flow. Automatic regulation of fuel and air to burner makes possible the maintenance of uniform steam temperature over any range of load and under any load variation.

Proper coal pulverization for the combustion requirements involved in this design, is assured through the use of the Kennedy Air-Swept Tube Mill Pulverizer which provides a continuous, dependable supply of superfine pulverized coal regardless of the quality of coal available, and at lowest cost per ton of coal handled.

Units of this type can be furnished for any capacities, pressures or temperatures and are recommended for use with bituminous or anthracite coals.

KVS PRODUCTS

Boilers
Air-Swept Tube Mill Pulverizers
Fans
Air Preheaters
Superheaters
Economizers
Water Walls
Coal Elevators
Bunkers
Coal-Weighing Scales
Ash Conveyors

KVS ENGINEERING

Kennedy Van Saun offers a complete service for the design, building and furnishing complete, ready-to-operate steam generating plants including all necessary components. This service is available under one responsibility. Your steam requirements will have the prompt, careful attention of KVS Engineers.

Ask for KVS Bulletin No. 44-B containing valuable information on steam generation and on the application and use of pulverized coal to steam boilers.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK USA · MFG. & ENG. CORP.

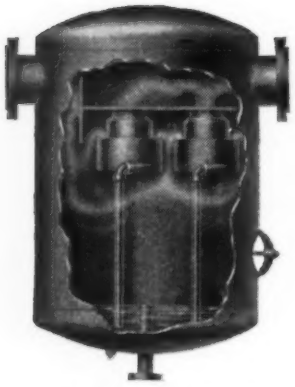
Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

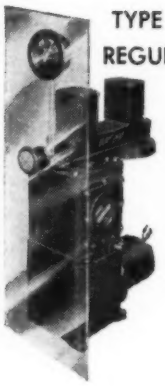
2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

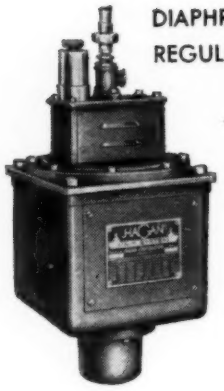
CANADA • ENGLAND • FRANCE • AUSTRALIA



STEAM SEPARATOR

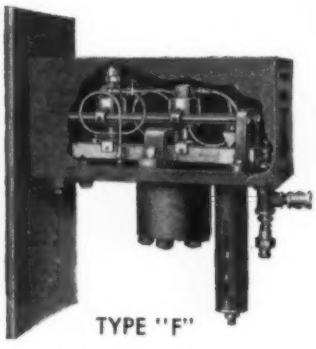


TYPE 2 SO
REGULATOR



DIAPHRAGM
REGULATOR

V PORT
BUTTERFLY
VALVE



TYPE "F"
MASTER SENDER

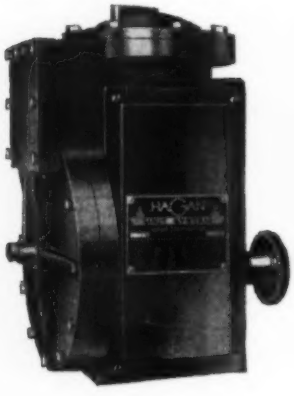
If you need equipment for any of these applications

RATIO RELAY

get in touch with HAGAN CORPORATION

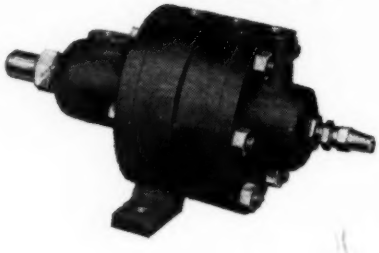
Hagan Building, Pittsburgh 30, Pa.

VARIABLE
RATIO REGULATOR

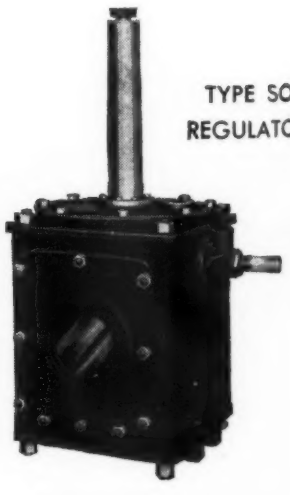


RECEIVING
REGULATOR

TYPE F
TOTALIZER



TYPE SO
REGULATOR



Combustion rate of boilers

Constant or graduated draft

Constant or graduated pressure (F.D.)

Feeder or stoker speeds

Flow of liquids

Control of multiple fuel firing

Fan speed control

Pump speed control

Hydraulic coupling control from speed or delivery of driven unit

Constant differential pressure (liquids or gases)

Constant differential draft (liquids or gases)

Graduated differentials (automatically or manually—liquids or gases)

Control of steam pressure

Control of pump discharge pressure

Control of pump discharge flow

Steam flow control

Steam pressure reduction

Steam temperature control (superheat)

Removal of oil and solids from exhaust steam

Removal of oil and moisture from compressed air

Steam desuperheating control

Separately fired superheaters

Flow of gases

Ratio control of gas flows

Ratio control of fuel and air (boilers)

Remote manual or automatic control

Flash tanks for recovery of steam from continuous blowdown systems

Program control for firing cycle

Oil burner control

Oil burner fuel-air ratio control

By-pass damper control for air preheater protection

Feed water heater pressure control

Feed water heater temperature control

Liquid level control

Control of multi-speed motor drives

Safety protection for gas or pulverized coal firing

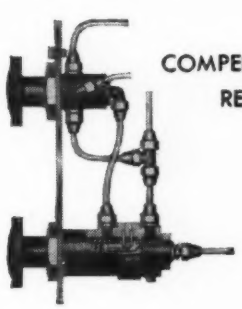
Steam jet refrigeration control

Removal of excess moisture and solids from saturated steam

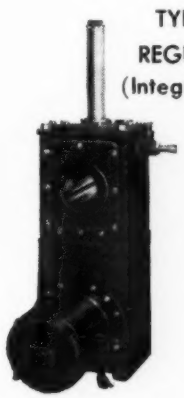
Force measurement and control

Measurement and control of Thrust and Torque

HAGAN
HALL
BUROMIN
CALGON



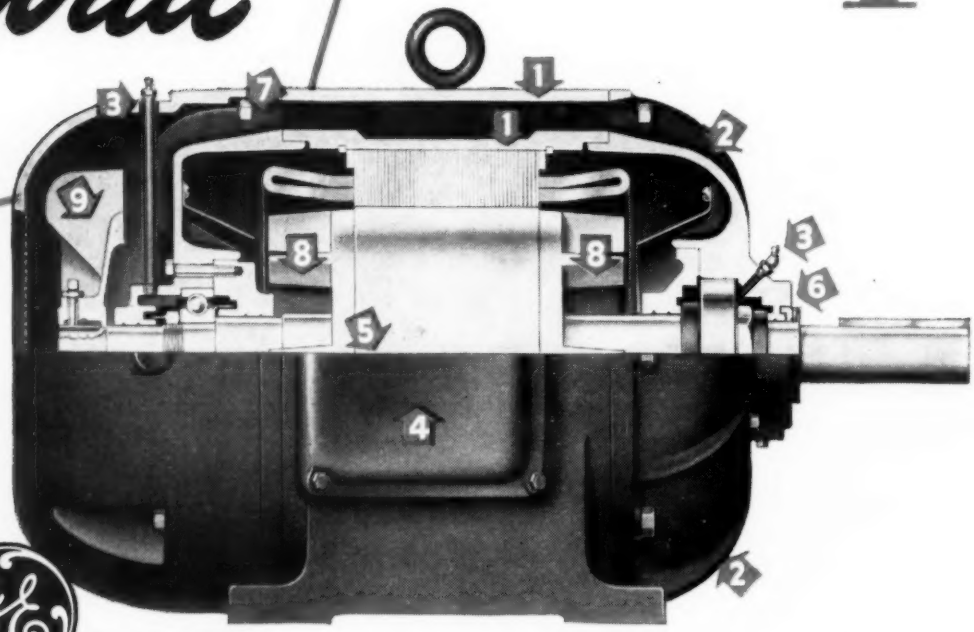
COMPENSATING RELAY



TYPE SO REGULATOR (Integral Pump)

HAGAN THRUSTORQ

A Double Wall Keeps



TRI CLAD

TOTALLY ENCLOSED STANDARD and EXPLOSION-PROOF MOTORS

These 9 points of new strength and serviceability put this TRI CLAD totally enclosed motor way ahead.

1. A cast-iron, double-wall frame that completely encloses windings and punchings
2. Ribbed, cast-iron end shields, machined to provide a tight seal, yet easily removed
3. Well-proved, pressure-relief greasing system which can be packed with a long-life lubricant where advisable
4. Cast-iron conduit box diagonally split for wiring convenience (independently explosion-proof on explosion-proof motors)
5. Leads are sealed in a nonshrinking compound at the point where they emerge from the frame
6. Rotating labyrinth seal prevents infiltration of grit or liquids
7. Large, free-flowing, easy-to-clean air passages protect parts from accumulation of dust and foreign material
8. Modern "ageless" insulation treatment includes Formex* magnet wire
9. Powerful external fan is removable, simplifying maintenance (nonsparking type for explosion-proof motors)

AND IN ADDITION—compactness and short length promote ease of handling and installation

*Trade-mark reg. U.S. Pat. Off.

FOR THE COMPLETE STORY

Apparatus Department
General Electric Company
Schenectady 5, N. Y.

Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motor.

Please send me GEA-4131, "Motors and Control for Hazardous Locations."

Name.....

Company.....

Address.....

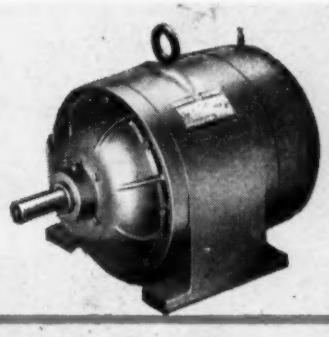
750-257-8030

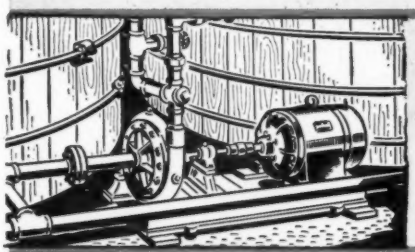
GENERAL ELECTRIC

Trouble Out

NEW TRI/CLAD TOTALLY ENCLOSED MOTOR IS MORE FULLY PROTECTED FROM DUST, DIRT, WEATHER, OR WHAT HAVE YOU...

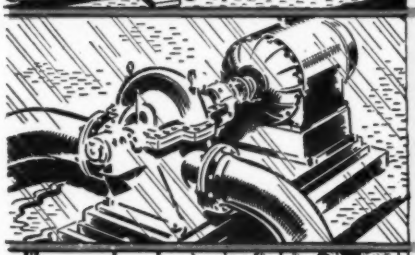
Now, General Electric has applied Tri-Clad construction to its line of totally enclosed induction motors (1 to 1000 hp) and to most of its explosion-proof motors as well. *Extra protection* has been raised another notch.





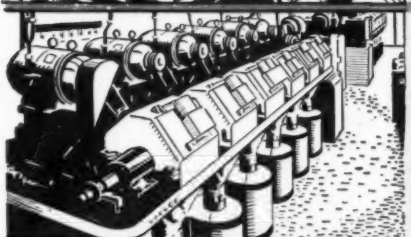
FOR EXTRA-SEVERE JOBS

Applications amid dust, metal filings, coolants, or corrosive agents—where totally enclosed motors have always been required—will now have the benefit of a stronger armor, plus convenience features that simplify installation and servicing.



FOR EXTRA-WET LOCATIONS

Indoors or out, these Tri-Clad totally enclosed motors will take hosings or heavy rains without danger of shutdown. The cast-iron frame is strongly resistant to rust and corrosion.

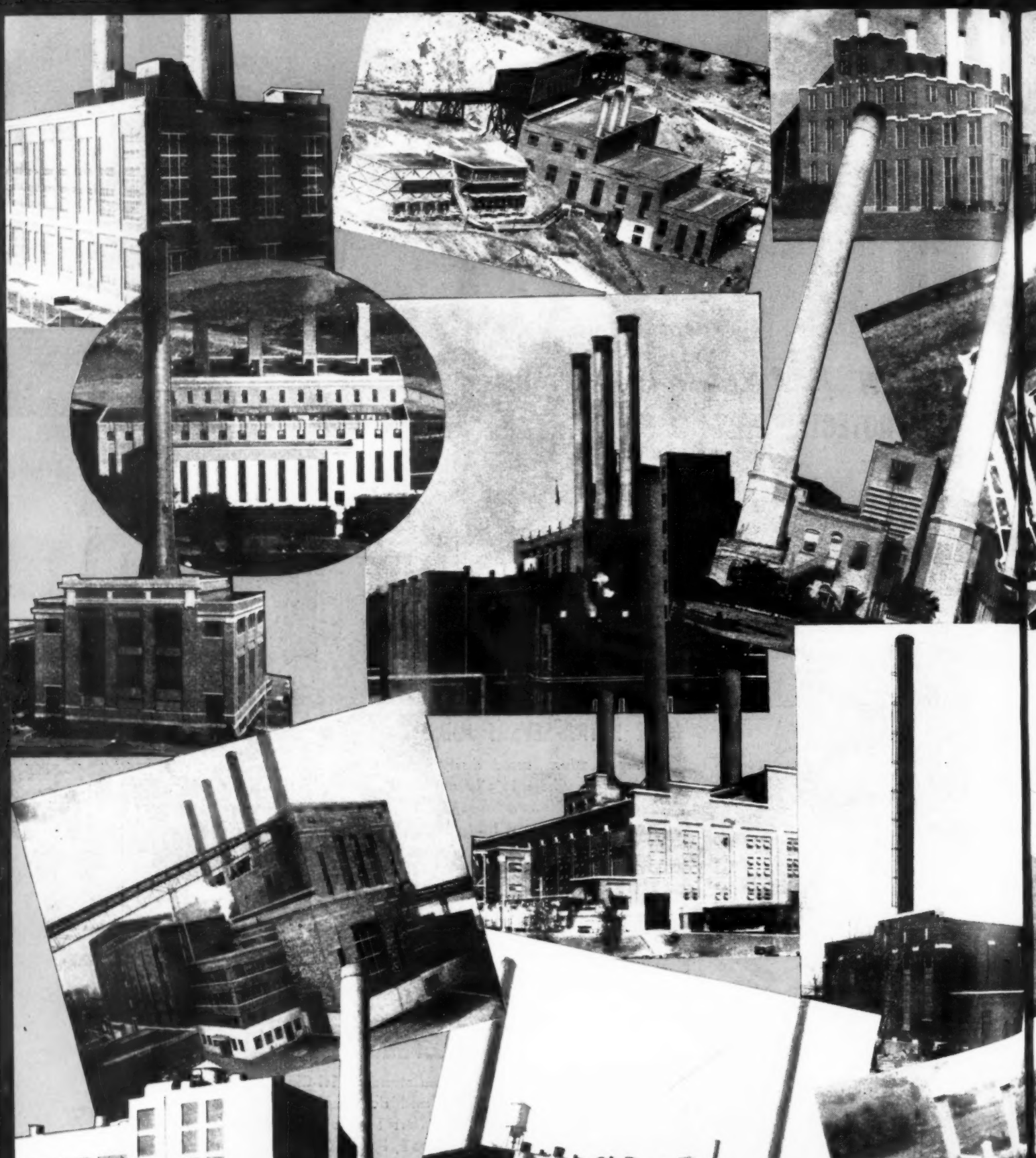


FOR HAZARDOUS ATMOSPHERES

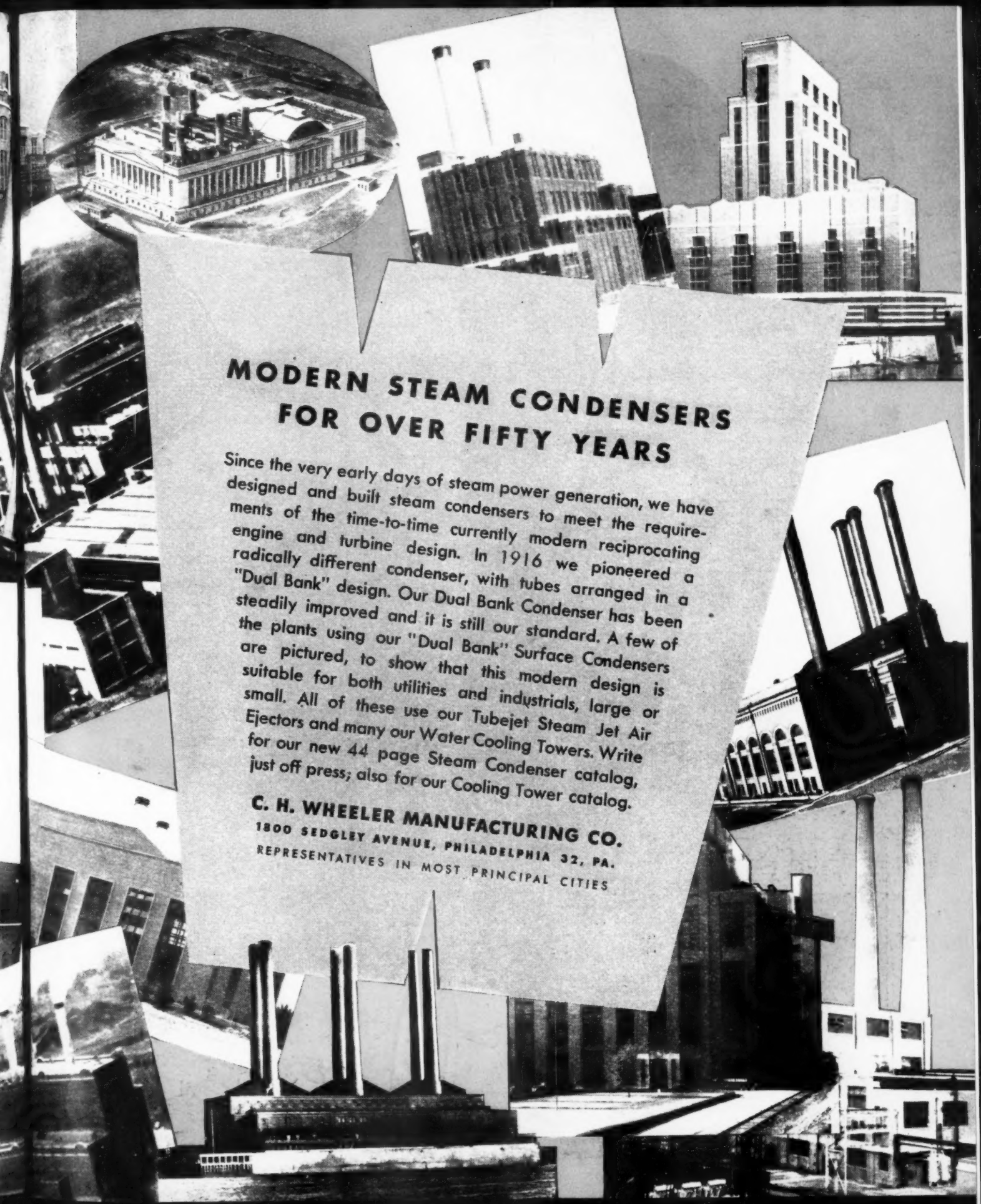
"Companion motors" to the standard Tri-Clad totally enclosed, the new explosion-proof and dust-explosion-proof types are tested and listed by Underwriters' Laboratories for Class I, Groups C and D, and Class II, Groups E, F, and G.

FOR EXTRA-LONG LIFE

Many motor users are making the totally enclosed motor their standard for *all* jobs—based on evidence of long-term savings. This new member of the Tri-Clad line makes this decision more logical than ever.



C. H. Wheeler

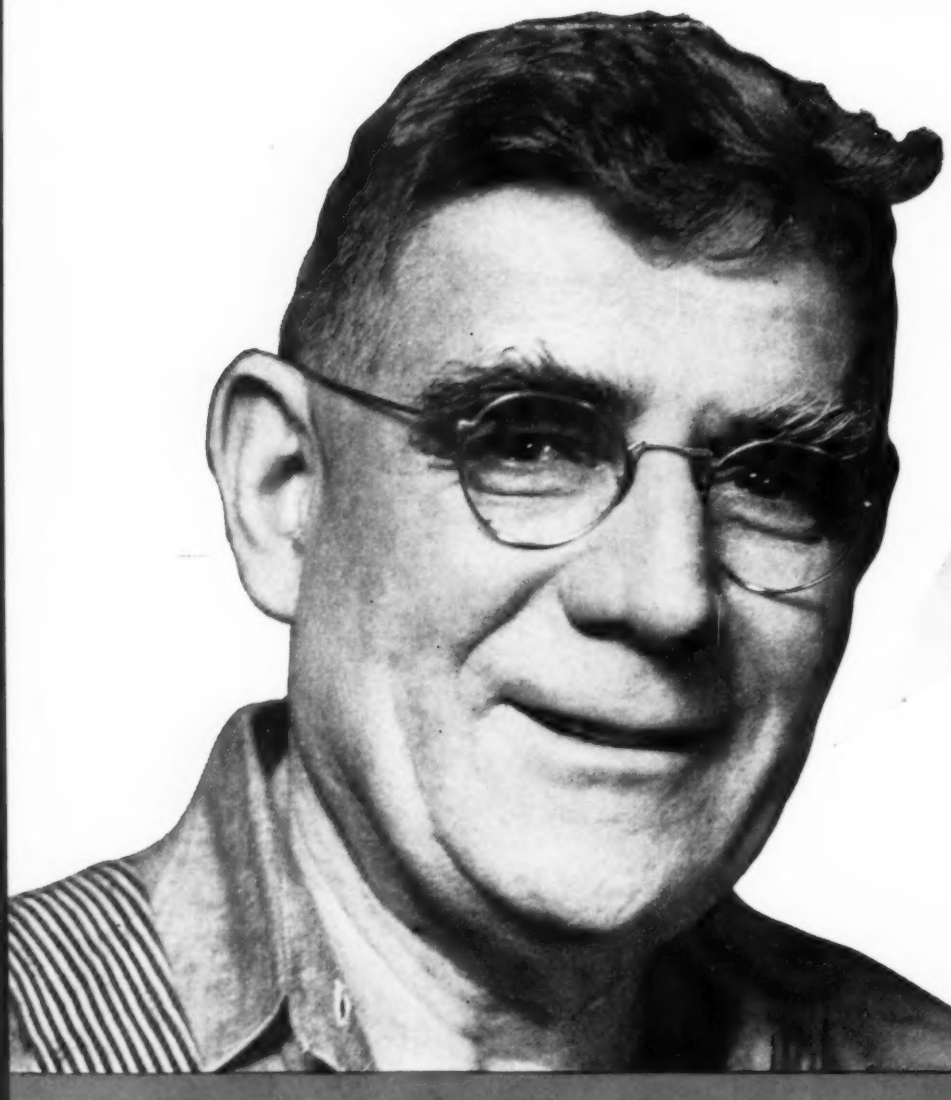


MODERN STEAM CONDENSERS FOR OVER FIFTY YEARS

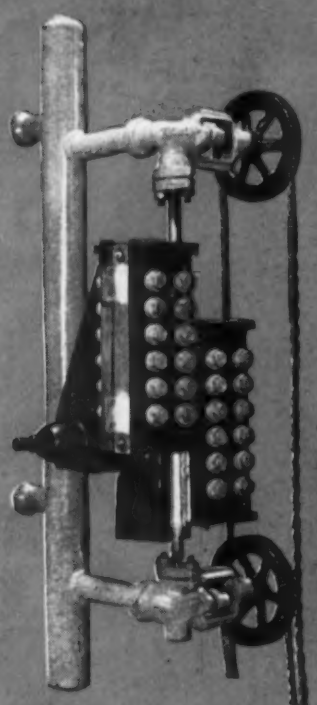
Since the very early days of steam power generation, we have designed and built steam condensers to meet the requirements of the time-to-time currently modern reciprocating engine and turbine design. In 1916 we pioneered a radically different condenser, with tubes arranged in a "Dual Bank" design. Our Dual Bank Condenser has been steadily improved and it is still our standard. A few of the plants using our "Dual Bank" Surface Condensers are pictured, to show that this modern design is suitable for both utilities and industrials, large or small. All of these use our Tubejet Steam Jet Air Ejectors and many our Water Cooling Towers. Write for our new 44 page Steam Condenser catalog, just off press; also for our Cooling Tower catalog.

C. H. WHEELER MANUFACTURING CO.
1800 SEDGLEY AVENUE, PHILADELPHIA 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

STEAM CONDENSERS • AIR EJECTORS
COOLING TOWERS • HEAT EXCHANGERS
OF PHILADELPHIA

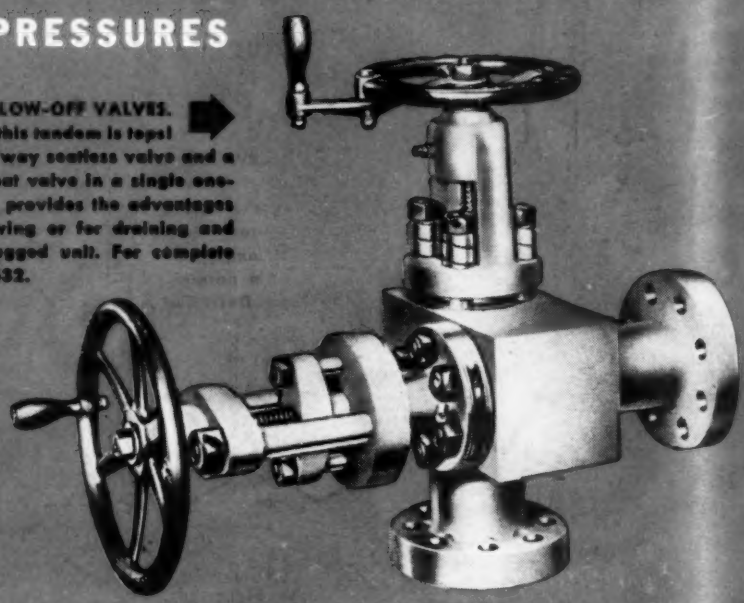


"GOOD *sure* with



FOR HIGH PRESSURES

YARWAY UNIT TANDEM BLOW-OFF VALVES. For pressures to 2300 psi., this tandem is tops! Combining the famous Yarway seatless valve and a specially-designed hard-seat valve in a single one-piece forged steel body, it provides the advantages of both designs—for blowing or for draining and scaling—in a compact, rugged unit. For complete description see Bulletin B-432.



YARWAY HIGH PRESSURE WATER COLUMN with welded GAGE VALVES AND FLAT GLASS GAGE... for 1350 psi. Improved design gives extra strength and dependability. Flat glass gage inserts are mica protected and have spring-loaded cover-plate cap screws and pressure-sealed gaskets which prevent excessive strain on glass. Described in Bulletin WG-1810.

YARNALL-WARING COMPANY, 100 Mermaid Ave., Phila. 18, Pa.

See the Yarway Exhibit at the National Power Show, Cleveland Public Auditorium, August 19-22.

YARWAY

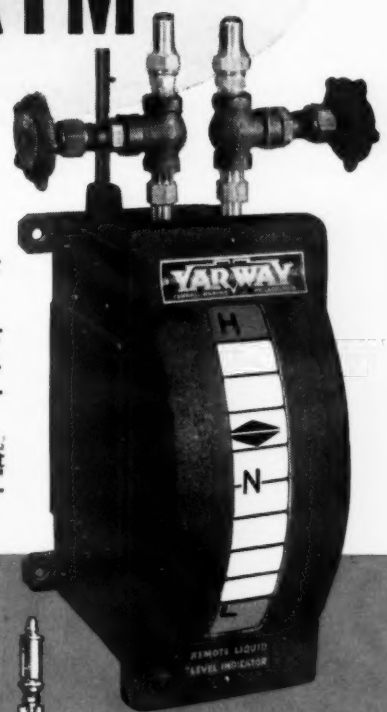
BOILER PROTECTION?
we Need it... and Get it
YARWAY BOILER TRIM"

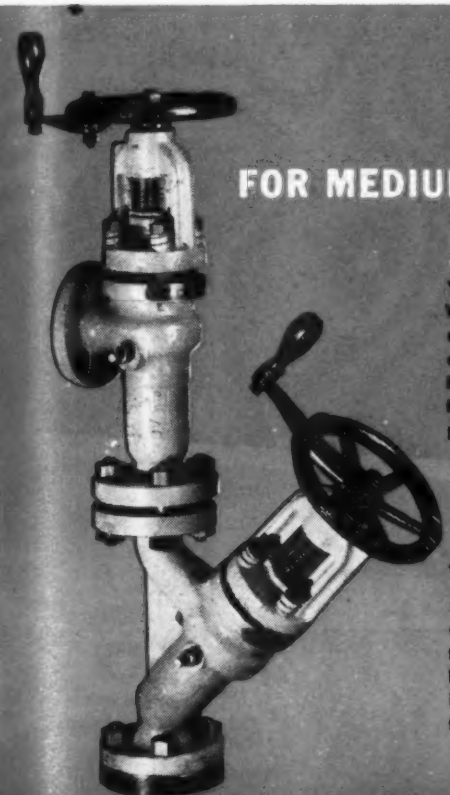
FOR ALL PRESSURES

YARWAY REMOTE LIQUID LEVEL INDICATOR. Here's an instrument that should be used with every boiler up to 1500 psi. It brings hard-to-see overhead water gage readings right down to eye level, on the instrument panel or other convenient place. Brilliantly-lighted red and green dial gives instant, accurate boiler water level readings. Always positive because it's operated by the boiler water itself.

Indicating mechanism is never under pressure. *There are no stuffing boxes.* Action is instant, constant, and practically frictionless.

Moderate in cost . . . easy to install. Get complete description and operating details in Bulletin WG-1820.

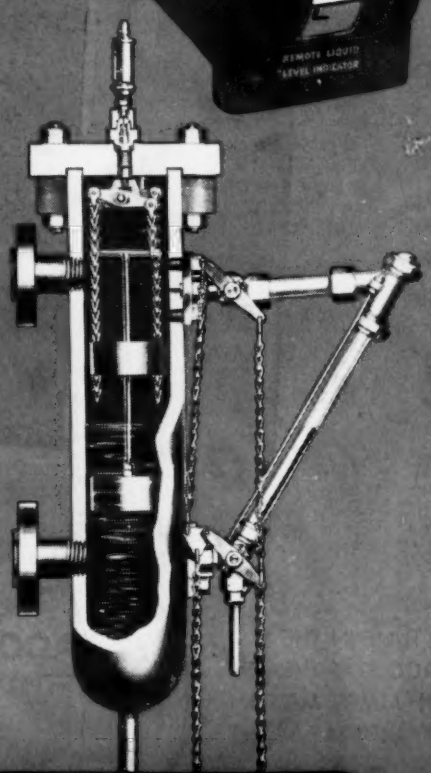




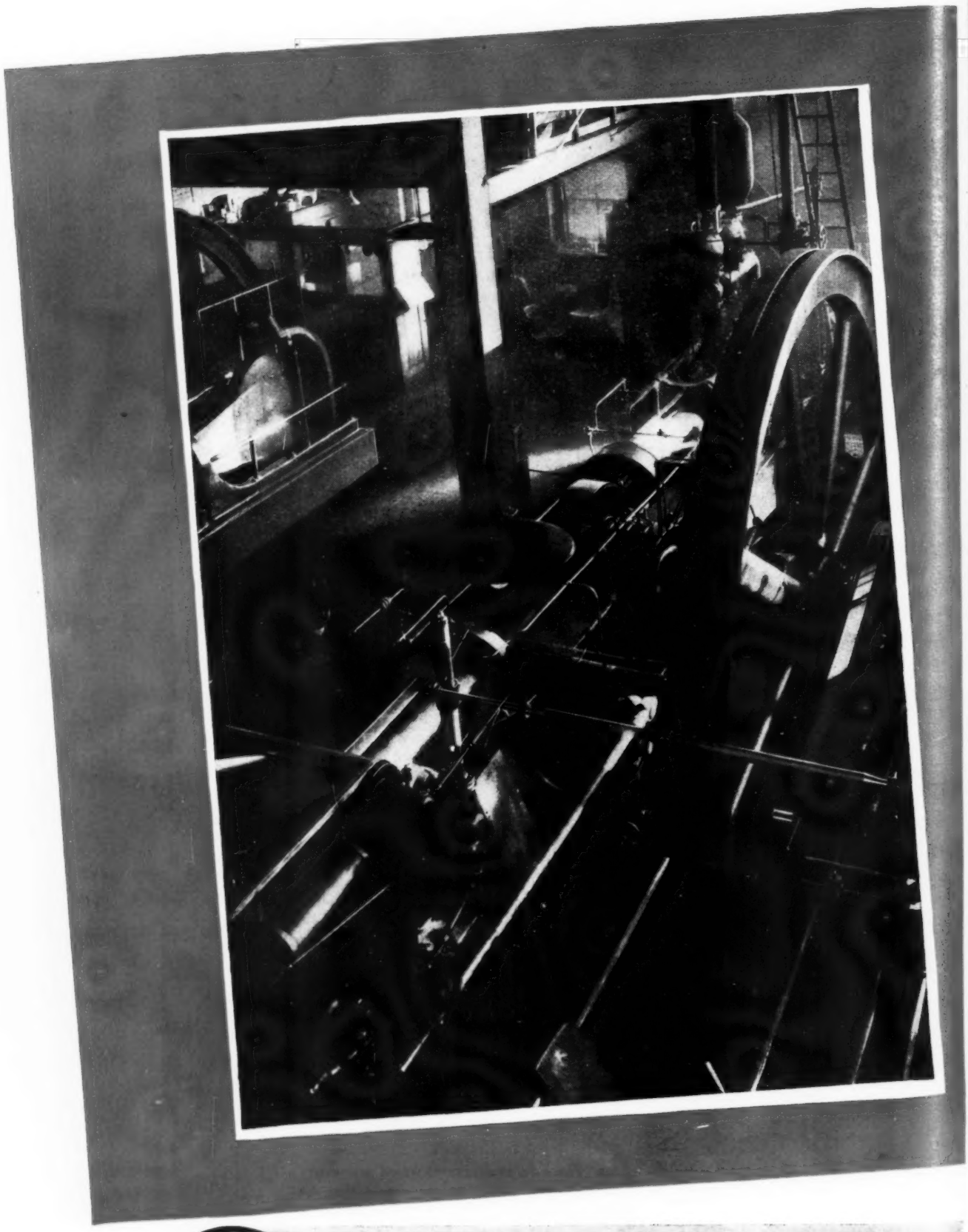
FOR MEDIUM AND LOW PRESSURES

YARWAY HI-LO ALARM WATER COLUMN WITH SESURE INCLINED GAGE. Alarm mechanism uses balanced solid weights and operates on the displacement principle to give instant, positive warning of dangerous changes from normal water level. For pressures to 400 psi. Described in Bulletin WG-1810.

YARWAY SEATLESS TANDEM BLOW-OFF VALVES. These are the valves that are standard in over 12,000 boiler plants on pressures up to 600 psi. Balanced sliding plunger type with non-clogging, straight-through flow. No seats to score, wear, or leak. See Bulletin B-424 for pressures to 400 psi.; Bulletin B-432 for higher pressures.



STEAM PLANT EQUIPMENT

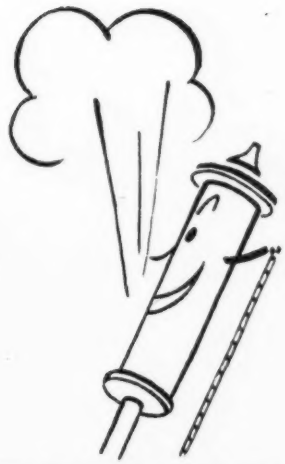


TUNE IN THE
TEXACO STAR THEATRE
WITH JAMES MELTON
EVERY SUNDAY NIGHT
— CBS

TEXACO

REG. T. M.

TEXACO



BETTER STEAM ENGINE PERFORMANCE

FOR more efficient, dependable and economical performance, use a steam cylinder oil that's *right* for your particular operating conditions. Texaco has a complete line of steam cylinder oils to meet every requirement.

You'll find that the Texaco steam cylinder oil recommended for your engine will atomize completely and adhere to cylinder walls. This is your assurance of reduced cylinder and piston wear, of extra protection for all vital parts, and greater all-around efficiency.

If you use your exhaust for processing, you can get Texaco oils especially designed to separate rapidly from exhaust or condensate.

Texaco Lubrication Engineers will gladly help you select the most effective oil to assure the best operation of your steam engine. Just call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

STEAM CYLINDER OILS

FOR EVERY STEAM CONDITION

PLANT WIRING AND RE-WIRING SIMPLIFIED

G-E No. 1799 VARNISHED-CAMBRIC INTERLOCKED-ARMOR CABLE MEANS

Quicker wiring today
Easier circuit changes tomorrow

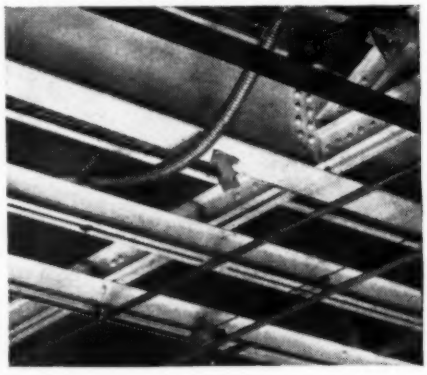
No. 1799 Varnished-Cambric Interlocked-armor Power Cable (600 volts)

Plants which met wartime deadlines for wiring time by the use of G-E interlocked-armor cable are among the big boosters for its peacetime use. It permits faster installation of power distribution systems—both primary and secondary circuits. Future relocation problems are simplified, too, because existing cable and fittings are easily adapted to new circuits.

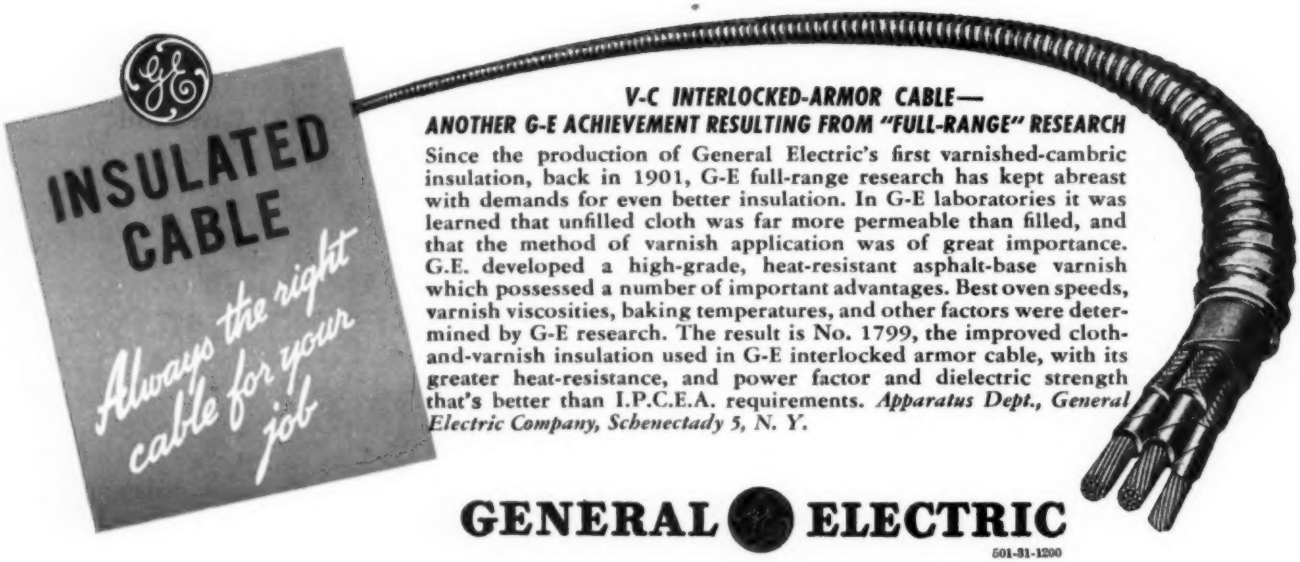
General Electric's No. 1799 varnished-cambric interlocked-armor cable—adopted to meet the urgent demands of speedy wartime installation—provides many time- and money-saving features for plant wiring. Actual installation time for power circuits can be cut as much as 50 per cent with this flexible cable for two reasons: (1) steel conduits and pull boxes are not necessary, and (2) comparatively little time is needed for layout of circuits because the cable can easily be bent around beams and obstructions. Other plant equipment can be erected immediately without "marking time" while waiting for wire and conduit systems to be put in place.

The initial cost of G-E interlocked-armor cable power distribution systems is frequently 25 per cent lower than for comparable wire and conduit systems, while high salvage value cuts the cost of changing circuits to meet varying load conditions. Important savings of steel and copper are made, and improved voltage regulation due to closer spacing of conductors results in increased machine output.

Large structural beams are easily by-passed



It will pay you to investigate these and other advantages before wiring new plants, or altering present power distribution systems. Your local G-E representative has the complete story.



V-C INTERLOCKED-ARMOR CABLE—
ANOTHER G-E ACHIEVEMENT RESULTING FROM "FULL-RANGE" RESEARCH

Since the production of General Electric's first varnished-cambric insulation, back in 1901, G-E full-range research has kept abreast with demands for even better insulation. In G-E laboratories it was learned that unfilled cloth was far more permeable than filled, and that the method of varnish application was of great importance. G.E. developed a high-grade, heat-resistant asphalt-base varnish which possessed a number of important advantages. Best oven speeds, varnish viscosities, baking temperatures, and other factors were determined by G-E research. The result is No. 1799, the improved cloth-and-varnish insulation used in G-E interlocked armor cable, with its greater heat-resistance, and power factor and dielectric strength that's better than I.P.C.E.A. requirements. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

501-31-1200

Foster Wheeler condenser passing the Maine Memorial, Havana, Cuba. This 60,000 lb. condenser traveled 1,500 miles by rail, ship and truck from Foster Wheeler's Carteret, New Jersey plant to Havana.

Designed for a Cuban textile mill, the surface condenser illustrated is a two pass direct flow type with more than 6½ miles of ¾" tubing.

Serving a 5,000 KW automatic extraction turbine and condensing a maximum 60,000 lb. of steam per hour, this condenser is designed to handle widely varying loads at required vacuum.

Differential spacing of tubes, a Foster Wheeler development, insures uniform penetration of steam to all condensing surfaces.

Experience has proved conclusively that the five basic requirements of an efficient condenser are distribution, penetration, air scavenging, devaporization and high condensate temperature. Foster Wheeler designs, product of fifty years' practical application in condenser engineering and construction, certify technical excellence in meeting these requirements.

FOSTER WHEELER CORPORATION
165 Broadway, New York 6, N. Y.

FOSTER WHEELER

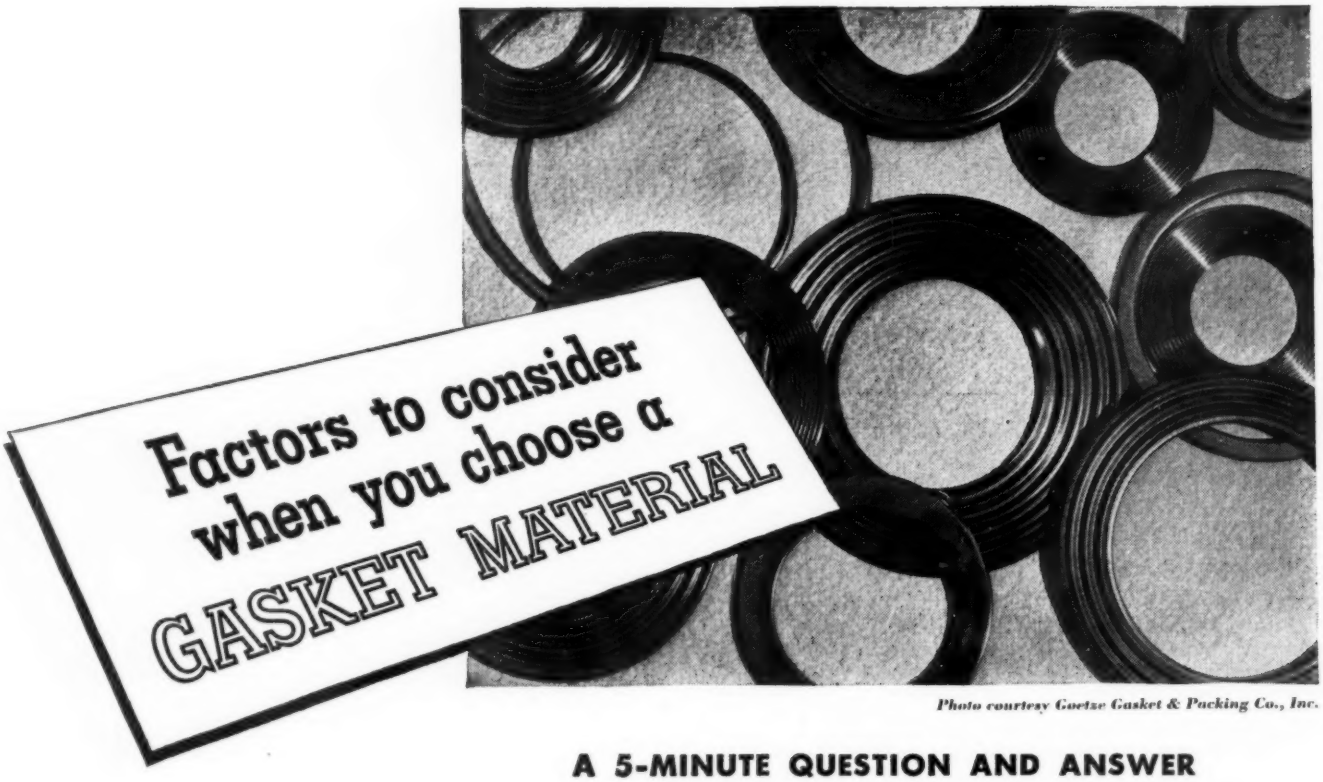


Photo courtesy Goetze Gasket & Packing Co., Inc.

A 5-MINUTE QUESTION AND ANSWER DIGEST ON GASKET SELECTION

Q. How many kinds of gasket material are there?

A. A wide variety of substances are used for gaskets. In general, they can be classified into three groups—nonmetallic, semi-metallic and metallic.

Q. What determines the type of gasket material to be used for a specific application?

A. The temperature and corrosive nature of the application. Non-metallic gaskets are generally used only when temperatures don't go above 250°F. Semi-metallic gaskets—usually metal-clad asbestos—are useful up to 850°F. For higher temperatures, only all-metal gaskets are satisfactory in high-pressure steam lines.

Q. What factors control the choice of a metal for high-temperature gasket applications?

A. Suitability of a metal for high-temperature gasketing service is determined by a combination of five physical properties.

Q. What are these properties?

A. Creep strength, ductility, corrosion resistance, thermal endurance and freedom from embrittlement.

Q. What is creep strength?

A. Under stress at elevated temperatures, metals slowly creep or flow. That is why strength figures for a metal or alloy based on tests made at room temperature are of little value when you are choosing a high-temperature gasket.

Q. Why is ductility so important?

A. When a gasket is installed, the gasket material must "flow" into irregularities of the flange faces to ensure a tight seal. *Ductility* is the property that enables a metal to do this.

Q. If only an edge-area of the gasket is exposed to the confined fluid, why is corrosion resistance important?

A. Once corrosion starts, the area under attack increases rapidly until leaks develop. Moreover, if the gasket corrodes or rusts, freezing of the gasket to the flange face means a tough, expensive replacement job.

Q. What is the importance of thermal endurance?

A. As temperatures rise above 400°F. they can readily burn the life out of ordinary metals. For high-pressure steam lines, you need a metal that may have to stand temperatures *more than twice as high.*

Q. What causes embrittlement?

A. Some metals become brittle when they are subjected to alternate cycles of heating and cooling. Cracks develop and finally whole pieces of the gasket break away. Although not every gasket installation undergoes these temperature changes, a metal's ability to stand them should be given careful consideration.

Q. Are there any metals that stand up well under these conditions?

A. One of the most suitable metals for high-pressure, high-temperature gasketing is Monel. It is as strong as steel, with the added feature of good ductility. It resists attack by steam, condensates, salt water and high temperatures. And it does not become brittle.

Q. What types of gasket are available in Monel?

A. All types—corrugated, serrated or plain. In addition, any practical shape, size or construction can be readily made in Monel by leading gasket manufacturers.

Q. How about the price of Monel gaskets?

A. Because *one* Monel gasket will outlast *several* made of less suitable materials, the cost alone will be considerably less. There is also a further saving in labor charges for replacements of cheaper gaskets and lost operating time. For example, in one steam installation operating at 1400 psi. and 850°F., Monel gaskets have lasted *more than 6 years without a single replacement.*

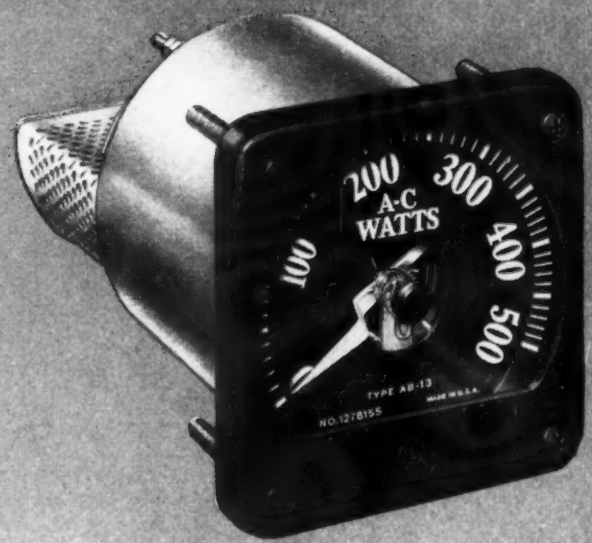
Q. How can I get more information to guide my selection of gaskets?

A. "Choosing a Gasket," an article prepared by the engineering staff of the Goetze Gasket and Packing Company, Inc., is available upon request. Just write: The International Nickel Company, Inc., 67 Wall St., New York 5, N.Y.

Reprints of this advertisement are available upon request from THE INTERNATIONAL NICKEL COMPANY, INC.

Now Available

for YOUR switchboards



TYPES

AB-13—A-C

DB-13—D-C

VOLTMETERS
A-C & D-C

AMMETERS
A-C & D-C

WATTMETERS

VARMETERS

POWER-FACTOR
METERS

SYNCHROSCOPES

FREQUENCY
METERS

ALSO

Temperature
Meters

Tachometers

LONG SCALE • EASY TO READ • SMALL SIZE • 1% ACCURACY

CONCENTRIC-SCALE instruments

Return with a great war record

Shortly before the war began, production of these instruments had just started. Radically new then—in terms of unusual readability for their small size—they were standardized on Navy installations and served successfully under more severe operating conditions than ever would be encountered in peacetime applications.

Only 4¼ inches square, yet having a scale 7 inches long, these instruments are ideal for large switchgear—they permit packing a lot of circuit information into a small space. They are well suited for console-type equipment where space is at a premium. In fact, they will serve well in practically any permanent or portable installation.

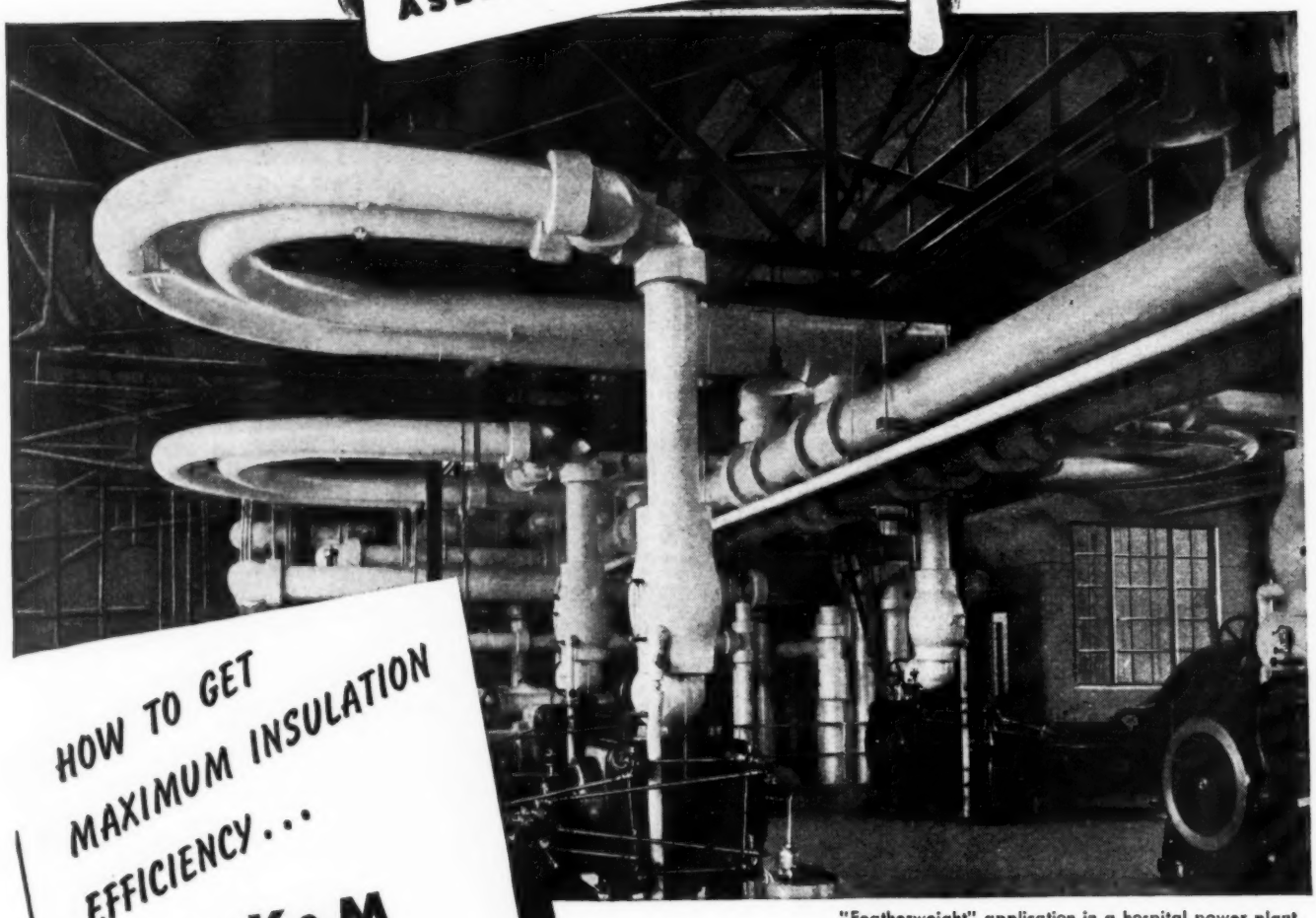
What's more, concentric-scale instruments are unusually sturdy, accurate to within 1 per cent, thoroughly shielded, and have many other excellent features to be found in Bulletin GEA-3432. For your copy, call the nearest G-E sales office. And when you write up your new specifications, call for concentric-scale switchboard instruments. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

HEADQUARTERS FOR MEASUREMENTS

GENERAL ELECTRIC

602-95-6200

ASBESTOS IN ACTION



"Featherweight" application in a hospital power plant.

HOW TO GET MAXIMUM INSULATION EFFICIENCY...

use K&M "Featherweight" 85% Magnesia

By using "Featherweight" 85% Magnesia on *all pipe flanges* as well as on the pipes themselves, you insure maximum heat control and insulation efficiency. Actual service has shown "Featherweight" to be the most efficient insulation of the moulded type for temperatures up to 600° F.—when properly and completely applied.

Combining the structural strength of selected asbestos fibres with the high insulating qualities of carbonate of magnesia, "Featherweight" 85% Magnesia is extremely light in weight, absolutely fire-proof, and mechanically strong enough to withstand all the rigors of ordinary usage. Write us for recommendations applying to your specific requirements.

K&M best in asbestos

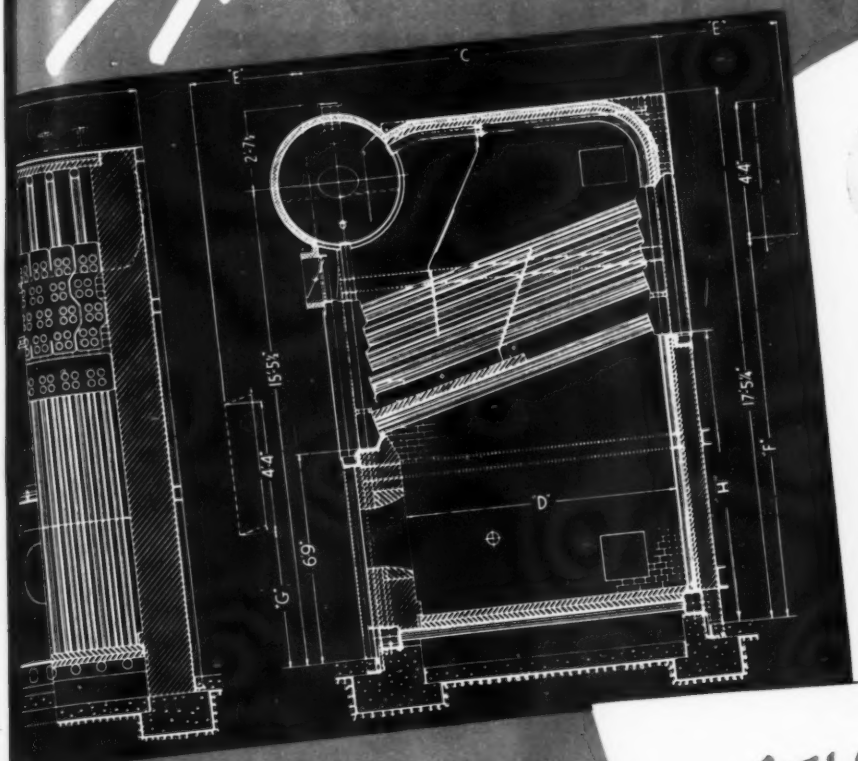
Nature made Asbestos

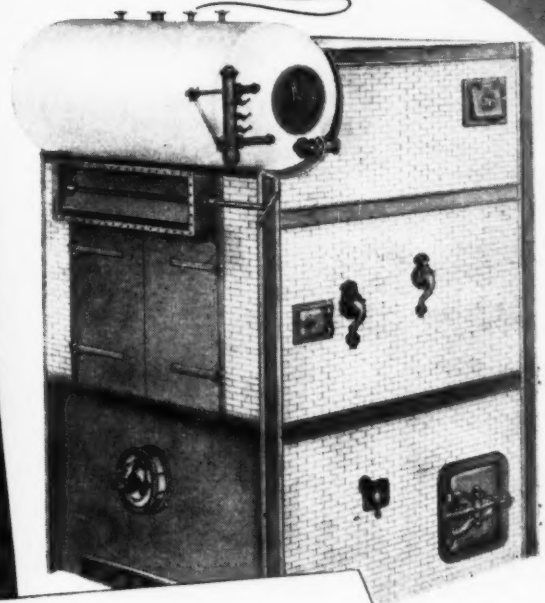
... Keasbey & Mattison has been making it serve mankind since 1873

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

Announcing...





STANDARDIZED TYPE M BOILERS

A New Development . . . Proven by Experience!

SPRINGFIELD standardized Type M Boilers are the logical answer to the problem of meeting rising costs and shortening current delivery schedules. By introducing a standard line, Springfield makes it possible for you to select a REAL POWER PLANT BOILER just as easily . . . accurately . . . conveniently as you order a pump, a motor, or a truck.

The Type M boiler is a tried and tested design, proven highly successful in meeting wartime steam needs. It is approved by reliable consulting engineers.

Ask for interesting descriptive literature.

SPRINGFIELD BOILER CO.
1953 E. Capitol Ave., Springfield, Ill.

QUICK FACTS

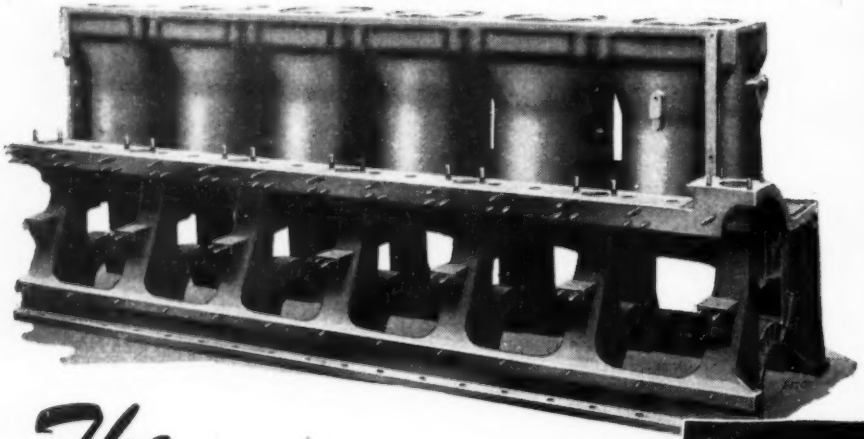
- **12 STANDARD SIZES.** Choose the size to fit your needs. From 6,000 to 17,000 lbs. of steam per hour (guaranteed continuous steam generating capacity).
- **STANDARDIZED DIMENSIONS.** Height, depth, all parts standardized; width varies according to size of unit — an ingenious application of the "building block" principle inherently present in the Springfield sectional design!
- **STANDARDIZED FIRING.** Designed for automatic firing with gas or oil. Use any standard industrial burner.
- **WATER-COOLED FURNACE.** Water circulating tubes in front, bottom, and back.
- **QUALITY CONSTRUCTION.** No departure from quality features of finest Springfield steam generating units.
- **LOW ENGINEERING COSTS. QUICKER DELIVERY.** Build your plans around standard Springfield units; save time; all data available. Factory stocks of standard parts facilitate quick delivery.

SPRINGFIELD BOILERS

SPRINGFIELD

STEAM GENERATING UNITS
ANY SIZE—ANY FUEL—ANY PRESSURE

The BACKBONE ---- of ONE OF AMERICA'S FINEST DIESELS



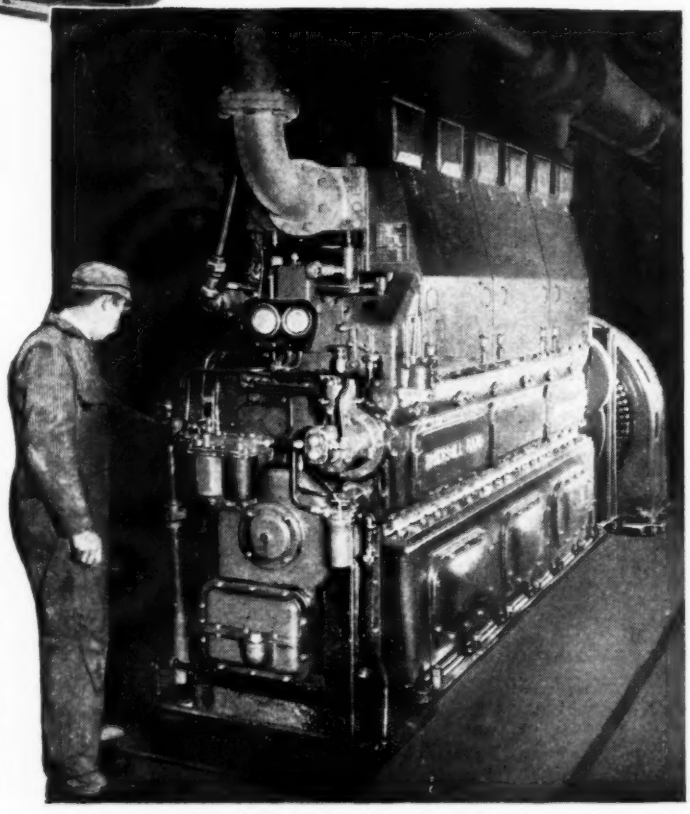
This single-piece casting is the housing for a 6-cylinder Type "S" Diesel Engine.

The TYPE "S" ENGINE

Has Cast En-Bloc Rigidity

The entire cylinder block and upper crankshaft housing of Ingersoll-Rand's Type "S" Diesel is a single piece casting. This construction not only assures maximum rigidity with minimum frame weight, but it means that crankshaft deflection is held to a minimum, a factor that directly affects main bearing life.

In addition to cast en-bloc construction, the purchaser of an Ingersoll-Rand Type "S" Diesel gets the benefit of such important features as twin fuel injection, a superb cooling system, and full force-feed lubrication with continuous filtering and cooling of lubricating oil.



Type "S" Diesel Engines are 4-cycle units built in 3, 4, 5, 6, 7 and 8-cylinder sizes for 225 to 600 hp. All sizes operate at 720 rpm.

COMPRESSORS • AIR TOOLS
ROCK DRILLS • TURBO BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS
OIL & GAS ENGINES

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

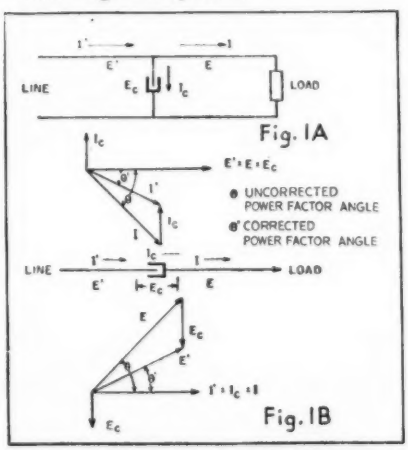
7-762

NO. 4

Helpful Hints on Applying Capacitors

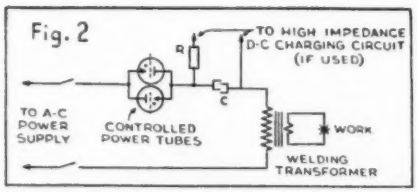
The Use of Series Capacitors for Industrial Circuits

Capacitors installed for power-factor improvement are normally connected in shunt with the load or system, providing an out-of-phase component of *current* to supply reactive kva. (See Fig. 1A.) In certain applications, however, capacitors perform another valuable function when connected *in series*. (See Fig. 1B.) Used this way, they provide an out-of-phase voltage component which has the effect of evening out voltage level under rapid intermittent loads. This is commonly known as "stiffening" the system.



DUAL-PURPOSE APPLICATIONS

In applications of series capacitors to "stiffen the system" for motor starting and the like, the capacitor kva is not high enough to raise the power factor significantly. In other cases, as on resistance-welding applications, for example, one of the functions of the series capacitor is to effectively furnish power-factor correction by compensating for the welder reactance. A shunt-connected capacitor is undesirable in this application because its output is constant and does not follow the load. The series capacitor, however, allows the feeder to handle more or larger resistance welding load.

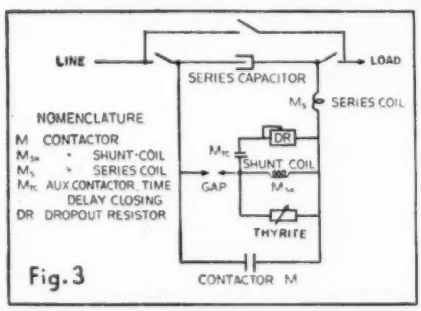


METHODS OF APPLYING SERIES CAPACITORS

When series capacitors are to be applied to resistance-welding circuits, their capacity and the circuit connections must be matched to the system of control (see Fig. 2). The following information is necessary to calculate capacity.

1. Kilovolt-amperes (volts × amperes ÷ 1000) and power factor (watts ÷ volts × amperes) under maximum working conditions.
2. Kilovolt-amperes and power factor with the electrodes directly short circuited, in order to determine maximum current and the protective requirements.
3. Line voltage and frequency.
4. Type of control, that is, mechanical contactor, synchronous or non-synchronous electronic control.
5. Duty cycle (cycles on, cycles off, pulsation per weld, and welds per minute).

The calculations required are made easy by the use of curve sheets* available for various supply voltages.

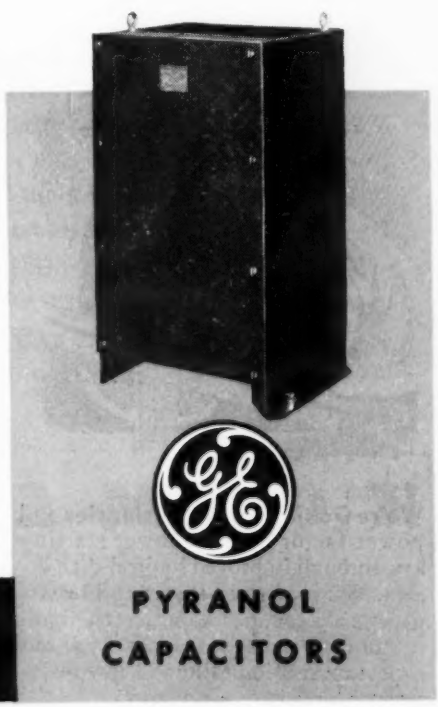


PROTECTIVE CIRCUITS FOR SERIES CAPACITORS

As the voltage across the series capacitor is a function of circuit current, it may be dangerously high for the dielectric under short-circuit fault conditions. A protective circuit may be desirable to by-pass such overloads, automatically reinserting the capacitor in the circuit when the fault current decreases to a predetermined value. See Fig. 3.

Whatever your problem in correcting power factor, eliminating light flicker or other function for which capacitors offer a remedy, G-E application engineers will be glad to work with you in selecting and applying them. Just call your local G-E representative. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

* Application of Series Capacitors to Resistance-welding Machines, reprinted from *Welding Journal*, Jan. 1943, GET 1134.

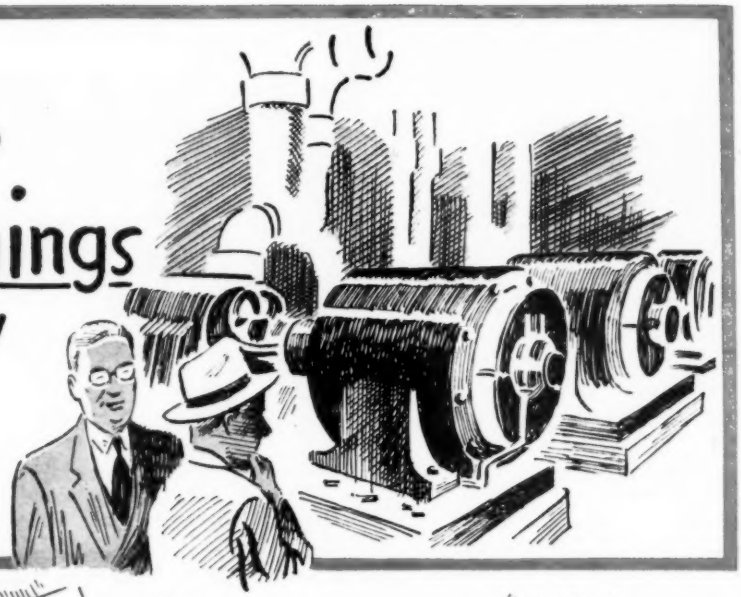


GENERAL ELECTRIC

407-105-3036

"For This Job, Give Me Two Things in a Motor"

. . . said the Power Plant Engineer



"To Drive Boiler Feed Pumps, motors must first be *simple.* For example, take these three Allis-Chalmers 800 hp, 3600 rpm motors. They're 2-pole, squirrel-cage, single winding machines . . . with practically fool-proof rotors and sleeve bearings. But second, and even *more* important . . .

They've Got to be Dependable! Here's what I mean. These same motors have given us 17 years of uninterrupted service. We've had to order replacement parts for them only twice . . . at a total cost of less than $12 a year. We call that *good performance* . . . the kind we've come to expect of *all* your motors!"

Frankly, Mr. Reader, we *are* mighty proud of our 2-pole motors. We've been developing them for high-speed requirements like this from the very earliest. Licked a lot of problems too. Like cutting down noise through better design . . . reducing windage noise with proper baffling, and curbing magnetic noise. . .

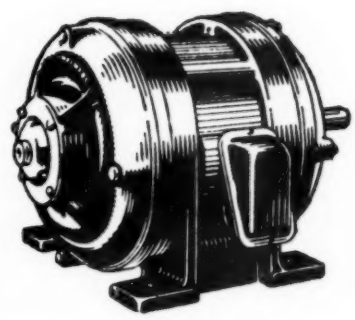
We're Getting Better Efficiencies and power factor . . . and lower starting kva, through improved squirrel-cage design. We've designed bearing brackets generously for greater structural rigidity. In fact, all the way around you can expect to find long life and low maintenance built-into our motors!

Yes, "A-C" Means Long Life in Motors!

REGARDLESS of size or type you'll be money ahead with Allis-Chalmers motors. For at A-C you can expect and *get* the same careful engineering, generous design and long-life operation that thousands of motor buyers have come to rely upon through the years.

And remember . . . while many jobs call for special or modified motors, there are *many more* that can be solved with *standard* motors . . . at less cost . . . and often with saving in time! ALLIS-CHALMERS, MILWAUKEE.

A 2082



ALLIS CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

EVER WIDENING SERVICE

Ever drop a pebble into a pool—and watch the ripples spread in ever-growing circles?

That illustrates the growth of Stephens-Adamson. From a modest beginning some 45 years ago, this company has steadily widened its service to industry to become a leader in the bulk materials handling field.

Each of those years has seen S-A service meeting the growing needs of expanding industry. Each has seen the development of new and better handling methods and new and improved conveyors and accessories.

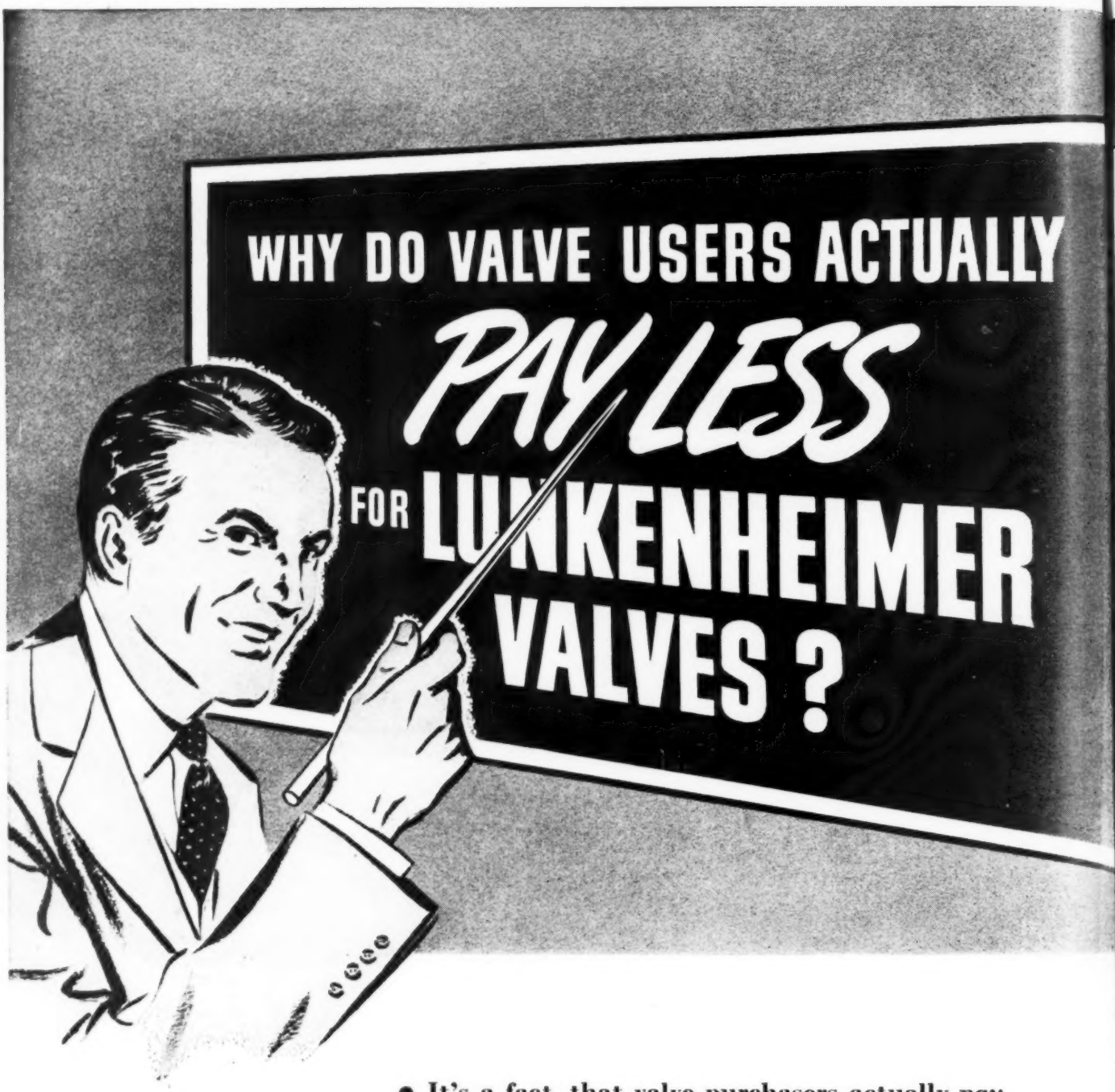
Today, the goal of S-A engineers is the same as always: to help you get the handling system that will convey the *right* volume to the *right* place at the *lowest* cost per ton. To that end, S-A today is field-testing many new methods and equipment.

On your next problem in bulk material handling, talk to the man who can give you the benefits of this ever-widening service. Talk to an S-A engineer.

STEPHENS-ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. • BELLEVILLE, ONT.

Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT



● It's a fact, that valve purchasers actually *pay less* for Lunkenheimer Valves—because these quality-built Valves give definitely *better service, longer service, more trouble-free and economical service.*

Maintenance men everywhere know they can confidently rely on the superior performance of any product bearing the Lunkenheimer name—backed as it is by a tradition of highest quality and skilled craftsmanship.

THE LUNKENHEIMER CO., Cincinnati 14, Ohio, U. S. A., New York 13, Chicago 6, Boston 10, Philadelphia 7. Export department: 318-322 Hudson St., New York 13, N. Y.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

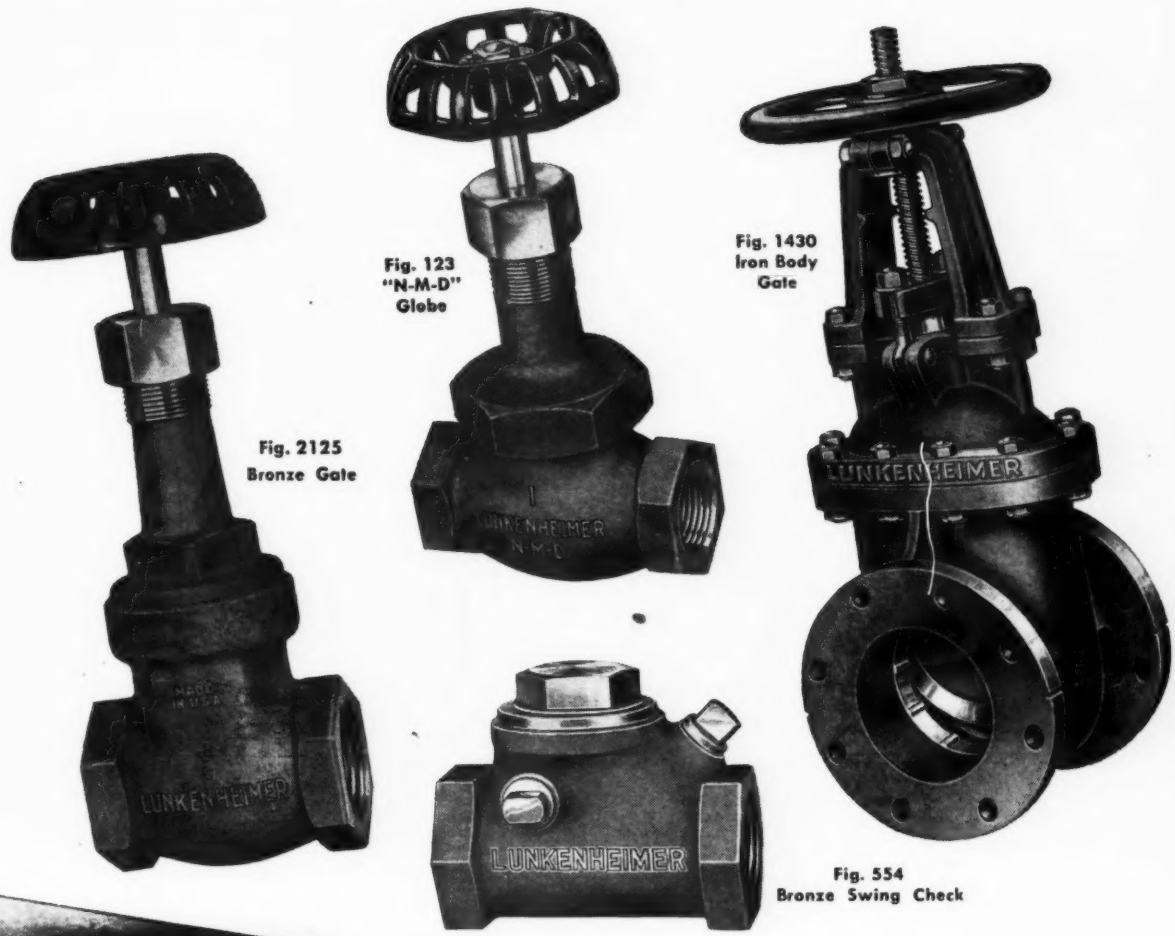


Fig. 123
"N-M-D"
Globe

Fig. 1430
Iron Body
Gate

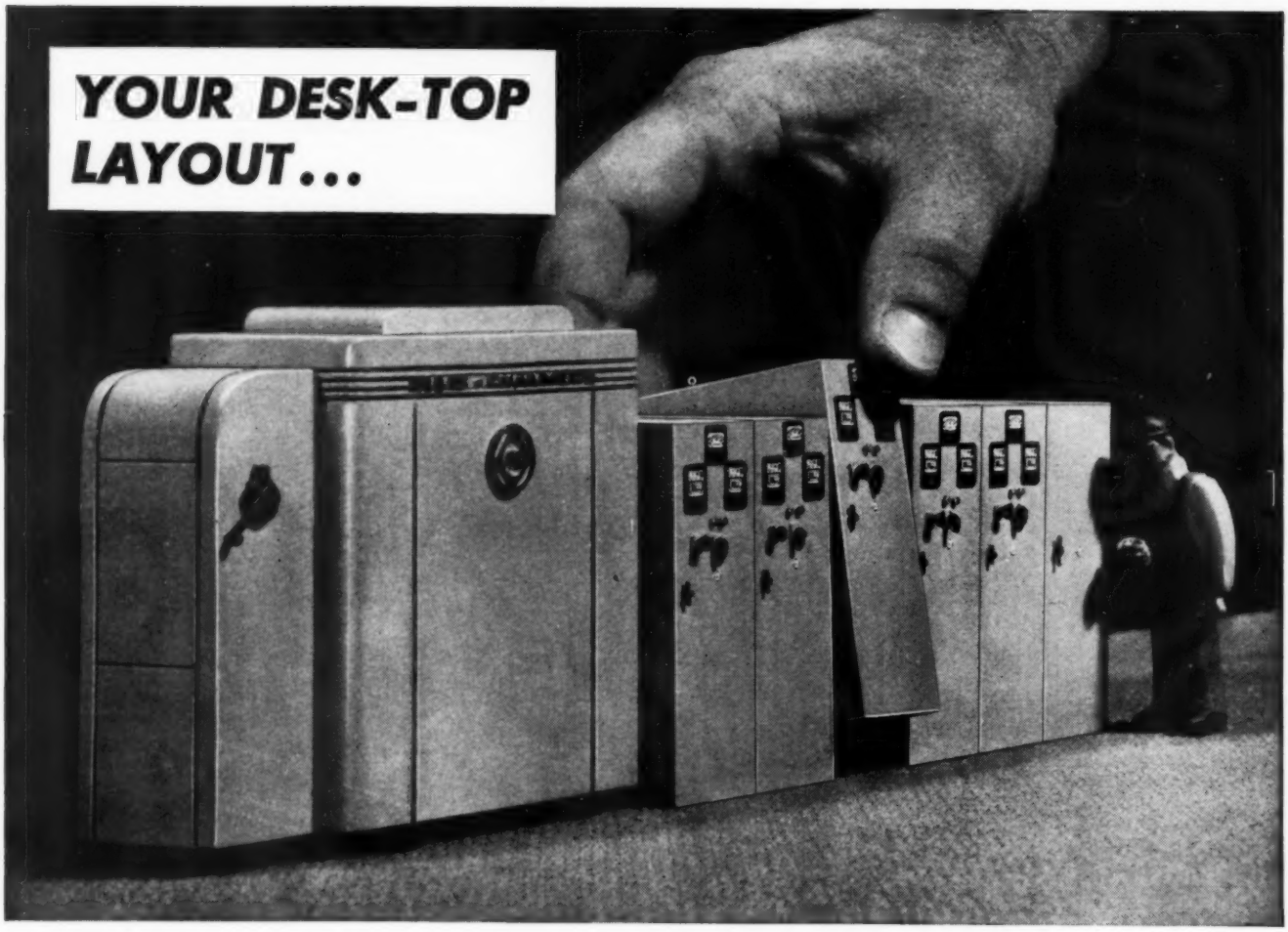
Fig. 2125
Bronze Gate

Fig. 554
Bronze Swing Check

YOUR LUNKENHEIMER DISTRIBUTOR

plays a very important part in rendering the *better valve* service for which Lunkenheimer is noted. He is fully equipped and ready at all times to help you solve problems of valve maintenance or operation. Lunkenheimer Distributors are located in all industrial centers. There's one near you . . . call him for your requirements.

LUNKENHEIMER VALVES



Buy From Sight,

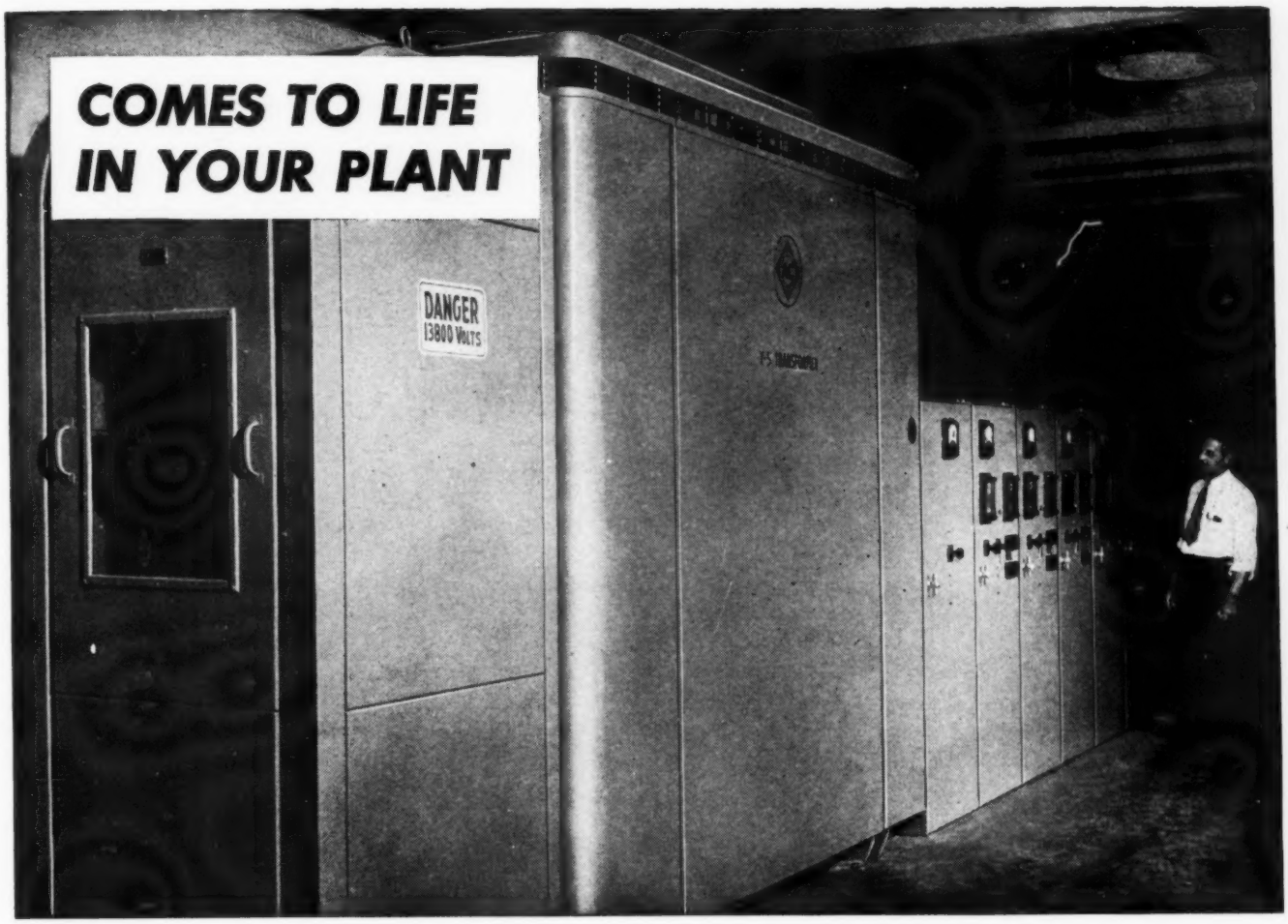
PROTECT YOURSELF AGAINST COSTLY ERRORS! ELIMINATE UNNECESSARY WASTE OF TIME! INSURE THE RIGHT UNIT SUBSTATION FOR YOUR PLANT — YOU DO ALL THREE WHEN YOU SOLVE YOUR POWER DISTRIBUTION PROBLEMS WITH THE HELP OF ALLIS-CHALMERS' "UNIT SUB BUILDER" SET!

YOU INSURE yourself against costly power distribution mistakes when you plan your unit substations *visually*. With the aid of Allis-Chalmers' "Unit Sub Builder" Set, you *pre-test* your ideas . . . see just what you're getting in terms of dimensions, characteristics, appearance.

In addition, visual planning is simple, practical, fast. *Right on the top of your desk* you can build up all possible solutions to your substation problems — compare them from every point of view.

For the last word in visualization, you can have a floor plan of your factory drawn to the same scale as the models — ½ inch to 1 foot; build up your unit sub *right where it will stand!*

All the elements making up Allis-Chalmers Prefabricated



and Buy Right!

—*with*

ALLIS-CHALMERS

Unit Sub Builder Set

Load Center Unit Substations are contained — in miniature — in the model kit. In addition, there's a "Unit Sub Slide Rule" to simplify breaker calculation and a valuable "Unit Sub Check List" to give you the added planning safety of a *double check*.

Models Prove Value

In the comparatively short period Allis-Chalmers' "Unit Sub Builder" Set has been available for assisting power distribution planners, engineers of many leading U. S. firms have taken advantage of its time-saving, trouble-saving benefits. They like the idea of working out solutions . . . without bogging down in complicated charts and catalogues.

This complete *and proven* service is yours with no obligation. To see for yourself how the models, check list, and slide rule can help you in the correct planning of your power distribution system, call your nearby Allis-Chalmers district office for a showing. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WISCONSIN.

A 1953

SKYROCKETED *to oblivion*

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000

This Valve DID THE TRICK

OUT they go on a one way ride that takes these "cost boosters and trouble makers" to a quick ending. There wasn't a chance for them because they were up against *streamline valve* performance. The same thing happens every time in every plant that installs the CASH STANDARD "type 1000" Pressure Reducing Valve.

You can find out the complete details on the "type 1000" by sending for Bulletin 962. See why the straight line flow ends the costs and losses that come with poor valve performance.

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs

CASH STANDARD CONTROLS.. VALVES

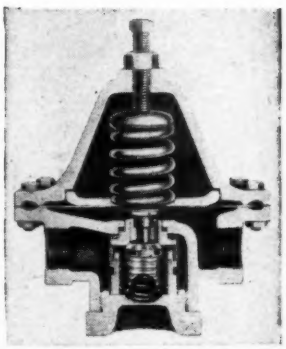
A. W. CASH COMPANY
DECATUR, ILLINOIS

•

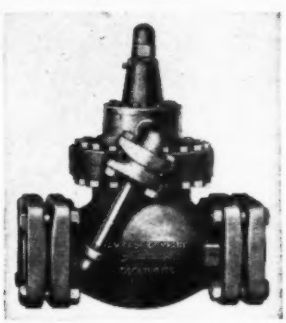
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

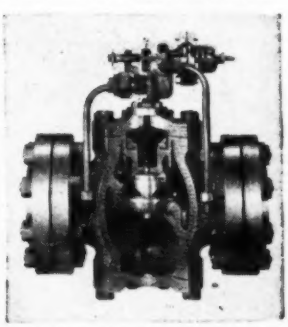
•



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

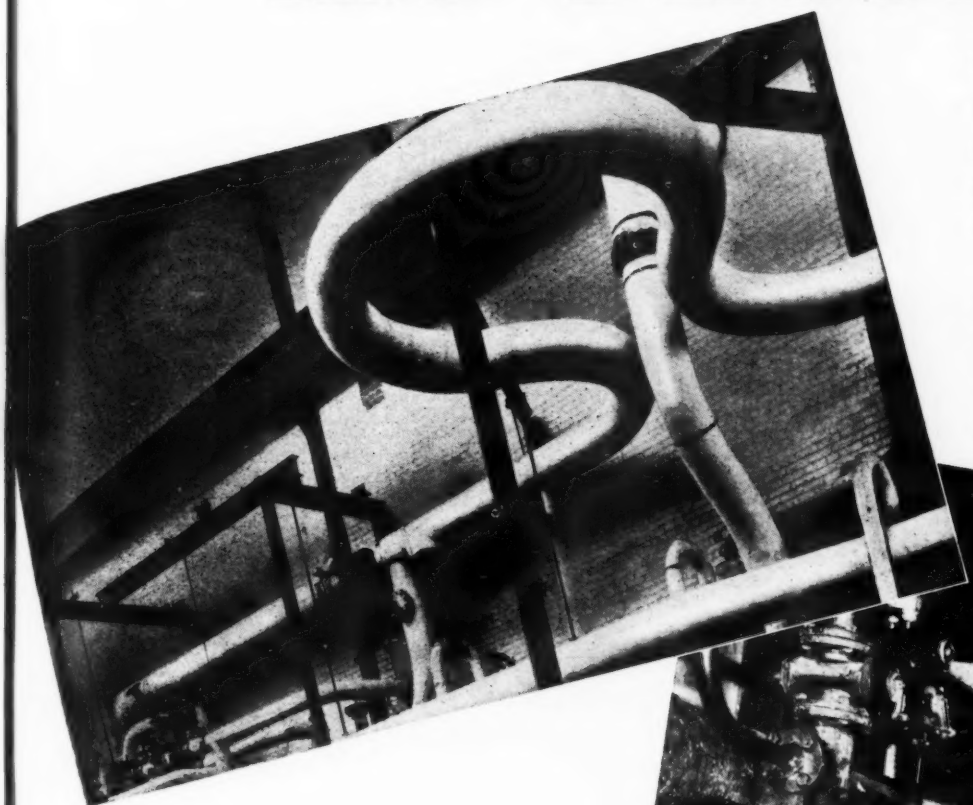


Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



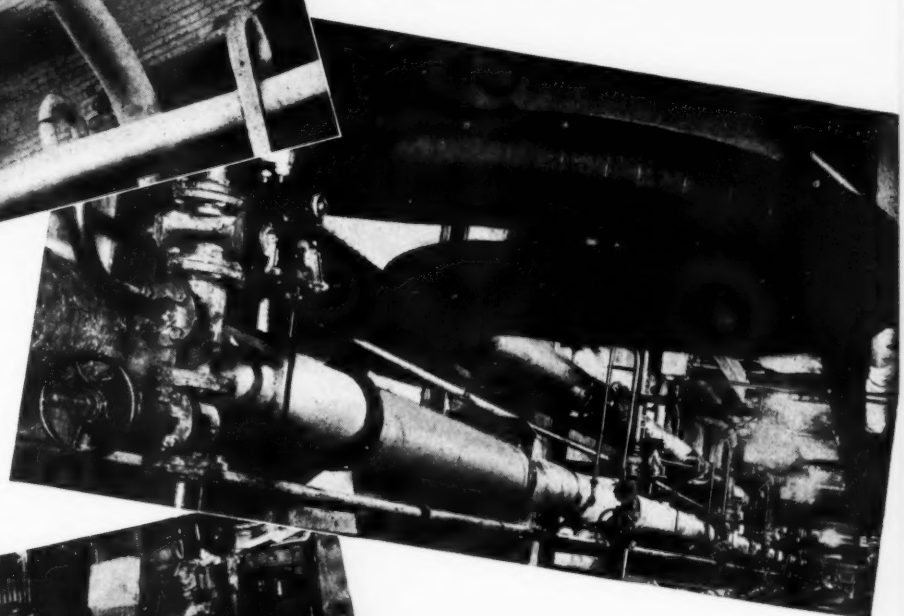
Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

PIPING PERFECTS *the* PROJECT



Proper design, layout, fabrication and erection of piping for power and for transmission of materials are imperative for the successful functioning of a process plant.

Successful operation of Blaw-Knox-built plants measures the importance that Blaw-Knox engineers attach to piping installations.



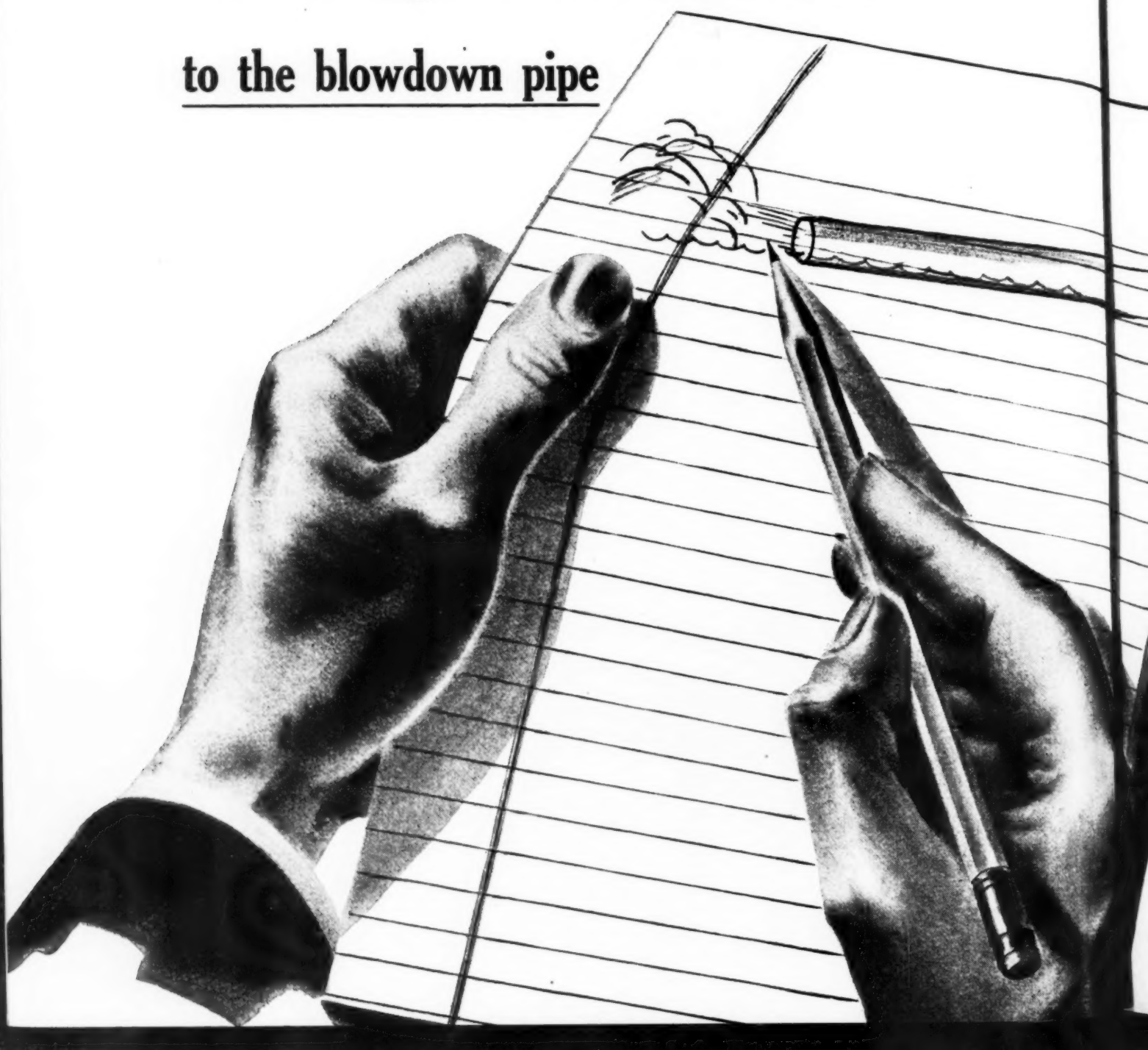
Seven Blaw-Knox plants have been awarded the Army-Navy "E", and have regularly received renewal stars for continued high achievement in the production of war matériel.

These two books constitute a service offered by Power Piping Division. They are written by engineers for engineers and will be sent free to any engineer or major executive who requests them on his own stationery. Ask for FLEX-ANAL CHARTS and Catalog No. 2026.

BLAW-KNOX COMPANY
POWER PIPING DIVISION 1525 PENNSYLVANIA AVE. N. S., PITTSBURGH, PENNA.

Continued heavy sludge

The Hall engineer traced the trouble to the blowdown pipe



SHORTLY after the installation of a new boiler in an eastern foundry, heavy sludge deposits developed. Plant engineers and the insurance company inspector were greatly concerned about the condition.

Analysis of this sludge showed that its composition was normal, with nothing to indicate under-treatment with phosphate. Nevertheless, water conditions were thoroughly checked, and control of the boiler water was watched with additional care. Still the heavy sludge continued.

To the Hall engineer this indicated the need for examination of the boiler itself. On the basis of experience in other plants, he questioned the location of the internal continuous blowdown line. When the boiler was taken off for inspection and cleaning, this was checked.

As he had suspected, the blowdown pipe was so located that slight variations in water level meant the difference between blowing boiler water or steam.

The pipe was lowered. Arrangements were also made for heavy blowdown of the mud drum and water wall headers immediately after the load was taken off the boiler when it was shut down at weekends. Six months later when the boiler was again inspected internal conditions were found to be satisfactory.

"Trouble-shooting" such as this is all in the day's work for Hall engineers. Their experience is not limited to water conditioning—they have a thorough knowledge of boilers and boiler operation. Our records show that time and again the troubles encountered in plants which have Hall service are due to factors other than water.

The ability of Hall engineers to trace and correct these troubles is one reason why *every plant that generates its own steam can profitably use Hall service.*

We will be glad to send you full information.

HALL LABORATORIES, INC., HAGAN BUILDING, PITTSBURGH 30, PA.
(A Subsidiary of Hagan Corporation)

HAGAN
HALL
BUROMIN
CALGON

HALL SYSTEM *of Boiler Water Conditioning*

Developed to meet YOUR Specific Operating Conditions . . .

NO MATTER how unusual the operating conditions in your plant may be, there are Sinclair *steam cylinder* and *valve oils* to meet them.

Sinclair *Steam Cylinder* and *Valve Oils* are made to provide dependable efficiency under *all* speed, temperature, pressure and moisture conditions, and other influences that affect lubricating performance.

Consult our engineers in selection of the most efficient oil for *your* specific operating conditions.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

Pumps that keep delivering!

Avoiding pump break-down and ensuing costly shut-downs for repair are vital economy factors in industrial management, as a recent survey has shown.

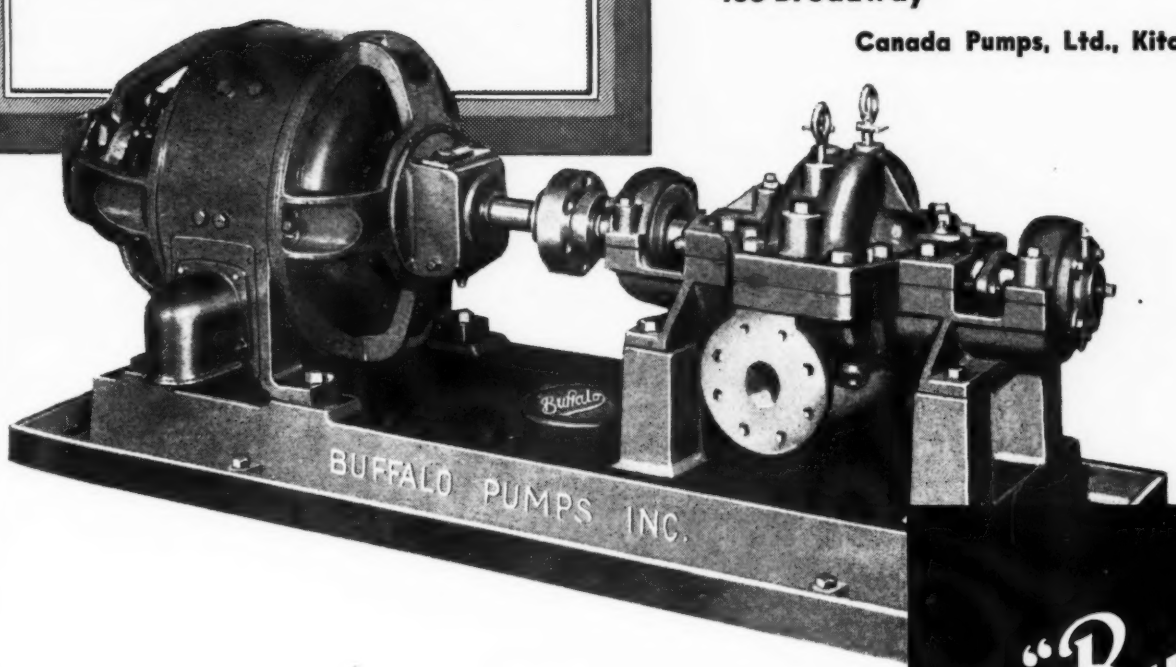
Here's where "Buffalo" General Service Pumps like the class "RR" Single Suction, Multi-stage Pump shown aid your budget. Sturdily built for longer, more efficient liquid handling in every detail . . . packing, impellers, shafts, bearings . . . they have proven themselves in hundreds of installations. Many "Buffalo" users state that you can "Put 'em in and forget 'em"! testifying to their ability to KEEP DELIVERING.

The perfect hydraulic balance and all-around quality workmanship in "Buffalo" General Service Pumps give you MORE for your pumping dollar.

BUFFALO PUMPS, INC.

488 Broadway **Buffalo, N. Y.**

Canada Pumps, Ltd., Kitchener, Ont.



PUMP FACTS!

You'll find assistance in solving many pumping problems in "Buffalo" bulletins, including ratings, specifications and other engineering data. Write us for your copy, or see your nearest "Buffalo" representative.

"Buffalo"

GENERAL SERVICE PUMPS

Let POWELL guide to assured,

Through the ages, men on land and sea have been guided to their destination by the *North Star*. It is easy to find because it is almost in line with the two stars on the right end of the "Big Dipper."

Many years ago Powell patented the famous "Star" Regrinding Globe Valve. Today, the *Powell Star*, backed by 100 years of accumulated technical knowledge and manufacturing skills, is serving Industry as a guide to assured, unfailing flow control. The Complete Powell Line includes valves for every known industrial service and as new demands arise Powell Engineers will design valves to meet them.

Catalogs gladly furnished on request. Kindly specify whether you are interested in Bronze, Iron, Cast Steel, or Corrosion Resistant Valves.

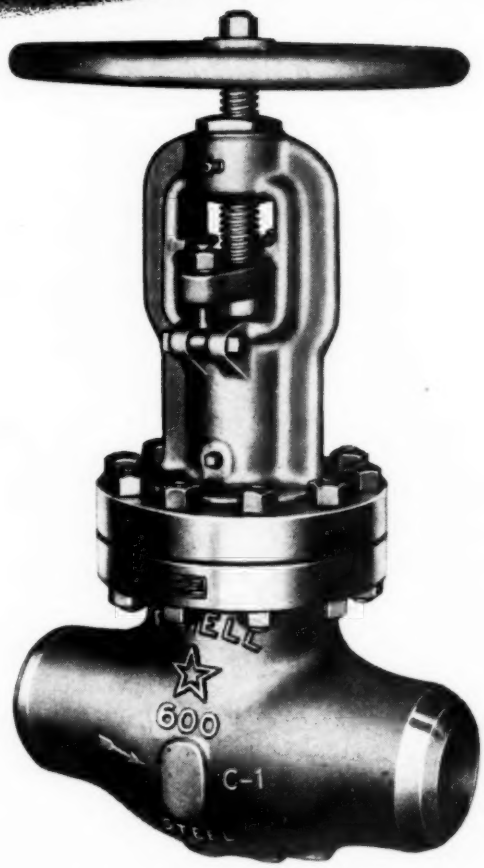


Fig. 6031 W. E.—Class 600-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke. Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.

The Wm. Powell Co.

Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL

your way ★ unfailing flow control

Fig.375

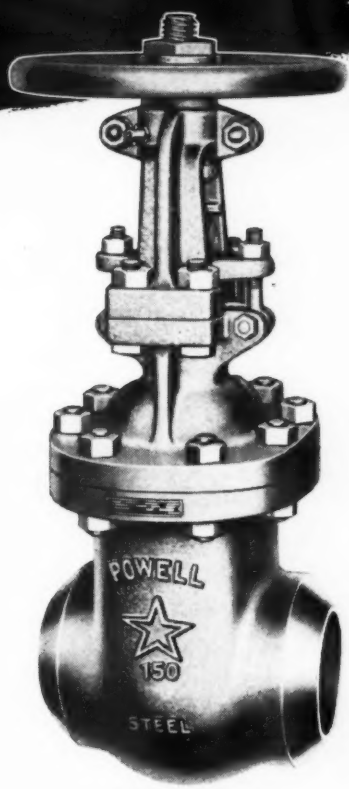


Fig. 1503 W. E.

Class 1500-pound, 6-inch, Cast Alloy Steel Gate Valve with welding ends and welded bonnet. Bevel gear operated.

Fig. 559

Fig. 375— Bronze "White Star" Gate Valve for 200 pounds W. S. P. Has screwed ends, inside screw rising stem, union bonnet, renewable, wear-resisting "Powellium" nickel-bronze disc.

Fig. 1503 W. E. — Class 150 - pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc.

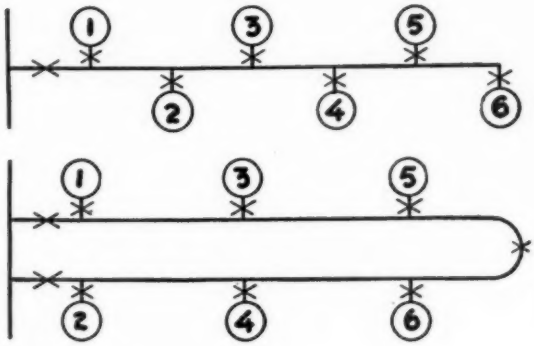
Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve. Flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc, Disc, when wide open, permits full, unobstructed flow through the valve body. Also available in All Iron.

VALVES

When he looped the header . . .

INSTALL STEEL PIPING
ADEQUATE FOR TOMORROW'S NEEDS

. . he halved his shutdown losses



PETE'S plenty happy, and for good reason. He just made a change in his lines that will save the Company real money. He simply looped and sectionalized the header that supplies six steam-heated kettles in his department.

Now, when something goes haywire, he can shut off the steam on one side of the loop, and keep production going on the other side until repairs are made. Result--shutdown losses cut 50%. All it took was a few dollars worth of pipe, welding flanges and turns, valves, insulation and labor. Anybody can see the value of that investment, when production is badly wanted the way it is now.

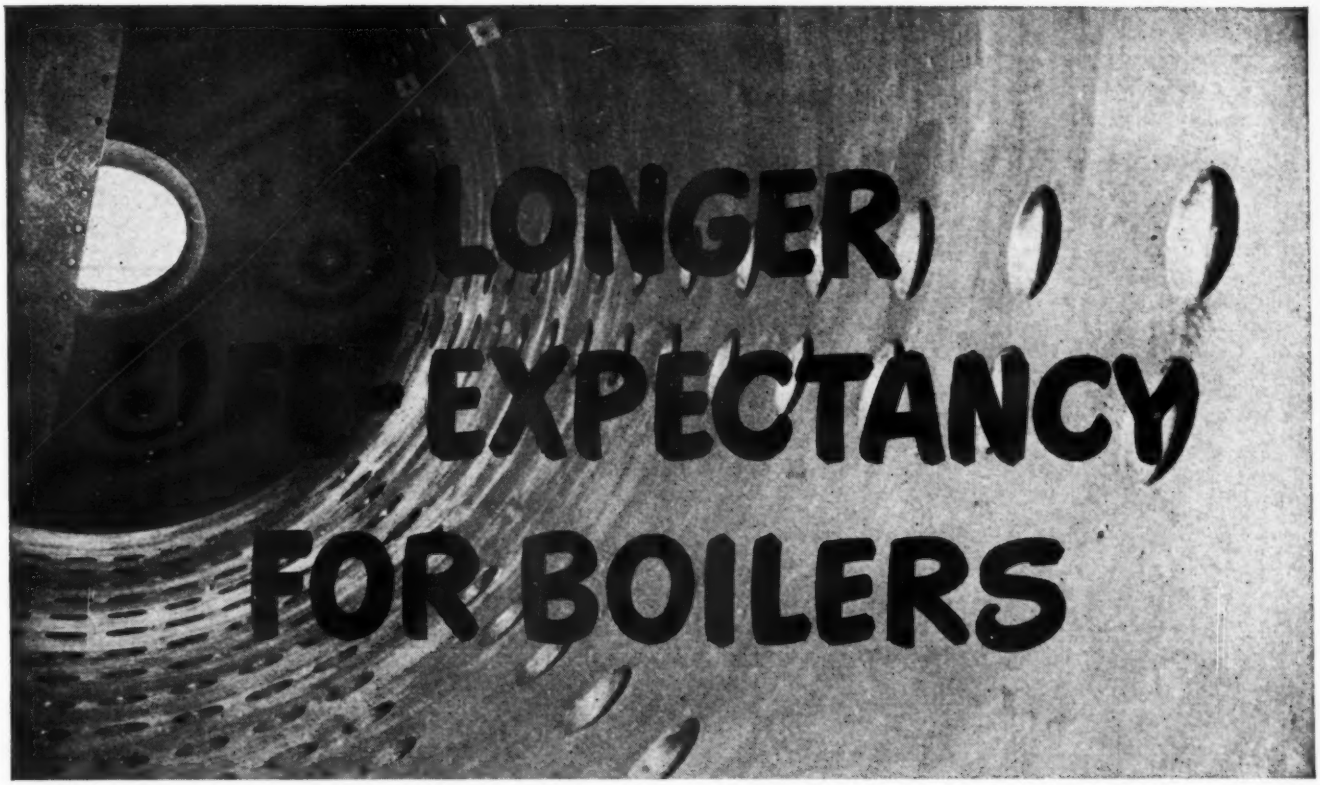
Ask Pete and he'll tell you it's long-run economy to install piping adequate to do a job, today or tomorrow.

Distributors in all industrial markets have Youngstown pipe in a wide range of sizes. For their names, write, wire or phone our nearest branch.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY
GENERAL OFFICES - YOUNGSTOWN 1, OHIO
Export Offices - 500 Fifth Avenue, New York City
Manufacturers of
CARBON - ALLOY AND YOLOY STEEL

Pipe and Tubular Products-Sheets-Plates-Electrolytic Tin Plate-Coke Tin Plate-Conduit - Bars - Rods - Wire- Cold Drawn Carbon Steel Rounds-Tie Plate and Spikes.



The thin coating of APEXIOR NUMBER 1 applied to the boiler interior shown above provides enduring protection in two important ways, both wholly mechanical in nature:

1. APEXIOR NUMBER 1 forms a moisture-proof seal for the metal surface, preventing contact with water and steam at all temperatures and pressures. Corrosion and embrittlement are definitely checked by this tough protective barrier.

2. APEXIOR NUMBER 1's smooth, chemically inert surface effectively retards operating deposits and prevents them from bonding tightly. Reduction in both amount and adhesiveness of deposits promotes boiler efficiency and simplifies cleaning.

These two mechanical properties of APEXIOR NUMBER 1 combine to provide longer boiler life, extended operating periods, easier and less expensive maintenance.

That such benefits are universally recognized is proved by the impressive list of railroads, steamship companies, power plants and manufacturers that find the regular use of APEXIOR NUMBER 1 a worth-while aid to efficient boiler operation. Steam turbine manufacturers apply it to shafts and rotor bodies before delivery, and these parts are benefited by its regular use. It is also applied to feedwater heaters and deaerators.

APEXIOR NUMBER 1 offers lasting, economical boiler insurance for stability, dependability and safety of operation.

APEXIOR NUMBER 3

For Metal in "Cold-Wet" Service

Where temperatures under 125°F. are encountered, APEXIOR NUMBER 3 similarly checks the corrosive action of moisture and water, fresh or salt, by completely sealing off metal-to-water contact. This special protection is advisable for such "cold-wet" surfaces as condensers, pumps, air washers, ship stern areas and every type of cold water tank, including those for drinking water.

APEXIOR coatings are easily applied with either hand-brush or power-coater. Free bulletin No. 1290 contains complete information. Use coupon below.

Two red-heat Dampney coatings are Thur-Ma-Lox Number 7 Black (1600°F.) and Thur-Ma-Lox Number 10 Aluminum (1200°F.). Properly applied, they provide lasting protection to dry metal surfaces subjected to the extreme temperatures indicated.

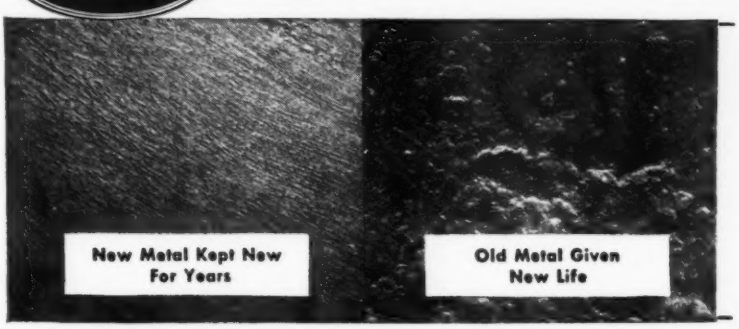
Organizations Like These Have Used APEXIOR for Years!

Louisville Gas & Electric Co.
The Proctor & Gamble Mfg. Co.
Home Oil & Refining Co.
Pillsbury Mills
Edge Moore Iron Works, Inc.
Aluminum Co. of America
Chevrolet Motor Co.
Parker Rust Proof Co.
The William Carter Co.
Lone Star Cement Corp.

APEXIOR

Keeps new metal new . . . Gives old metal new life

DAMPNEY



THE DAMPNEY COMPANY OF AMERICA
1281 River Street,
Hyde Park, Boston 36, Mass.

Please send free Bulletin 1290.

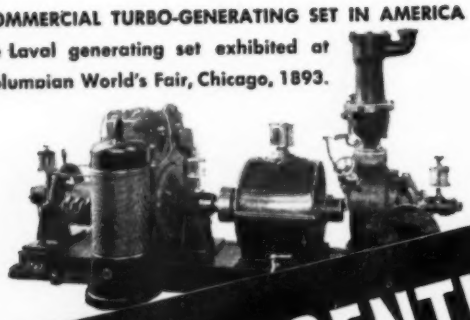
Name.....

Company.....

Address.....

.....

FIRST **COMMERCIAL TURBO-GENERATING SET IN AMERICA**
De Laval generating set exhibited at Columbian World's Fair, Chicago, 1893.



A HALF CENTURY OF PROGRESS *in* TURBINE DESIGN *by* DE LAVAL

MODERN DE LAVAL MULTI-STAGE TURBINE
driving a 6,000 kw, 60 cycle alternator.

The highly perfected De Laval turbines of today are the direct result of the early achievements of Dr. De Laval, who in the year 1888 made the impulse type of turbine a practical and efficient power-producing machine by his invention of the diverging nozzle now employed in all impulse type turbines . . . For steam turbines of all types and sizes, consult De Laval.

T-1

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER • DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON • KANSAS CITY • LOS ANGELES • MONTREAL
NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TORONTO • TULSA • VANCOUVER • WASHINGTON D.C. • WINNIPEG

POWER

A McGRAW-HILL PUBLICATION

N O WYNKOOP, *Publisher* P W SWAIN, *Editor*

L N ROWLEY, *Managing Editor*

Associate Editors:

F A ANNETT E W FELLER B G A SKROTZKI

Assistant Editors: J L KING J C McCABE C F SANDERS

Art Editor: C F MARSCHALEK

Business Manager: B E SAWYER

Washington: D D Hogate *Atlanta:* Earle Mauldin

WORLD NEWS OFFICES: *London, Paris, Berlin, Moscow, Prague, Shanghai, Bombay, Mexico City*

AUGUST 1946 VOLUME 90, NUMBER 8

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURE ARTICLES

Consolidated Edison plans to complete Waterside modernization.. 64
Viscosity: most important property of lubricating oil..... 68
Capacity of mercury-arc rectifiers..... 70
Six of world's largest pumps protect Cincinnati against floods.... 71
Wide range of designs fit roller bearings to each application..... 74
Fan laws simplify performance calculation..... 77
Experience with automatic air soot blowers..... 80
Portable 3-fluid U-tube stand speeds flowmeter testing..... 83
Shortcuts to plant efficiency: No. 6—How many boilers?..... 86
New developments in gas turbines and boiler-plant practice.... 88
Charts shorten time to calculate flue-gas moisture and volume.... 92
Power personalities: Warren Lewis..... 95
Bonneville Dam—Panorama of power..... 98
Busbars create unbalanced circulating current in 3-phase system.. 99
Radiant heating maintains the body in healthful comfort..... 101

THE OPERATING ENGINEER

Boiler patches: bolted, riveted or welded?..... 103
A blacksmith tackles mass production..... 105
Practical aids..... 106
Reader's problems..... 110
Pump Q & A..... 114
Water-treatment question box 118
Math tips..... 120
'How to—'..... 122

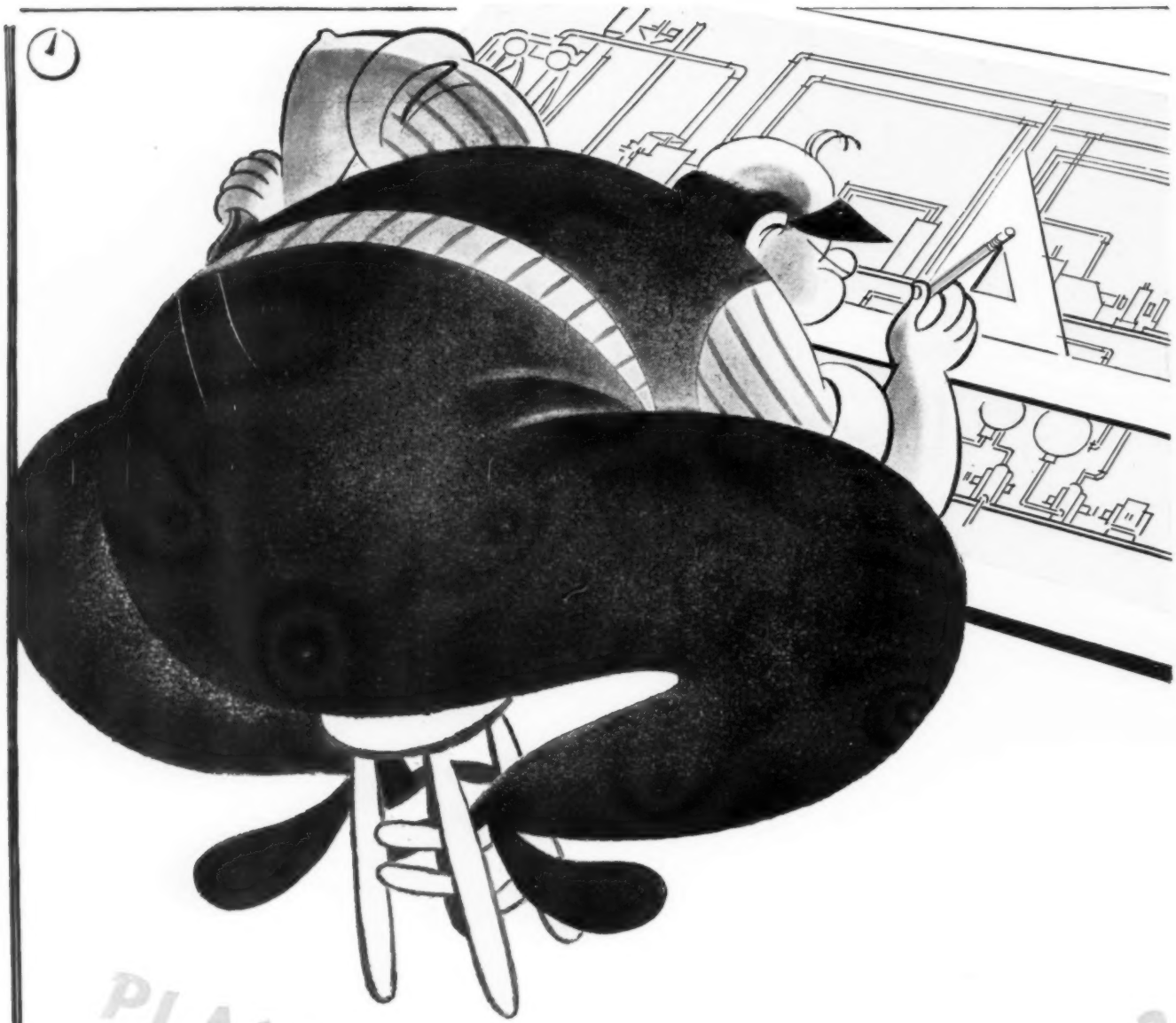
OTHER DEPARTMENTS

Power news..... 124
New Plant equipment..... 126
Data sheet..... 134
George Edwards..... 136
Argument corner..... 140
Free bulletins..... 186a

VOLUME 90, NUMBER 8 • ABC • ABP •

COPYRIGHT 1946 by McGRAW-HILL PUBLISHING CO., INC. • ALL RIGHTS RESERVED

James H McGraw, Founder and Honorary Chairman; James H McGraw, Jr, President; Curtis W McGraw, Senior Vice-President and Treasurer; Joseph A Gerardi, Secretary; Nelson Bond, Director of Advertising; Eugene Duffield, Editorial Assistant to the President; J E Blackburn, Jr, Director of Circulation • DISTRICT MANAGERS: New York, W W Quarles; Philadelphia, C R Long; Cleveland, F. B Godley; Chicago, C Boughton; Boston, C L Morton; St Louis, G G Sears • PUBLICATION OFFICE: 99-129 Broadway, Albany 1, N. Y. • EDITORIAL AND EXECUTIVE OFFICE: 330 W 42nd St, New York 18, N. Y. • Cable Address: "McGraw-hill New York" • DISTRICT OFFICES: 520 N Michigan Ave, Chicago 11; 68 Post St, San Francisco 4; National Press Bldg, Washington 4; 16 S Broad St, Philadelphia 2; 738-9 Oliver Bldg, Pittsburgh 22; 1510 Hanna Bldg, Cleveland 15; 2980 Penobscot Bldg, Detroit 26; Continental Bldg, St Louis 8; 1427 Statler Bldg, Boston 16; 1011 Rhodes-Haverty Bldg, Atlanta 3; Pacific Finance Bldg, Los Angeles 14; Aldwych House, Aldwych, London WC2 • POWER articles are indexed in both the industrial Arts and the Engineering Index • POWER issues its own Index annually; copies are available on request to the editorial office, 330 W 42nd St, New York 18.



PLANNING NEW POWER . . . ?

Two steam power plants are seldom the same. Usually, each has its special set of requirements and operating conditions. These will govern the equipment selected. But there *are* certain *basic* principles, common to all, governing the *type* of equipment. They've been evolved through experience—and tested in use.

Whether you're building a new plant or expanding an old one, these principles will serve as a valuable guide for your functional planning. Westinghouse, builder of the majority of products in a modern power plant, is well qualified and ready to place this information at your disposal.

Westinghouse

PART ONE

GETTING STARTED

Types of Turbines
Sizes of Turbines
Turbine Speeds

PART TWO

PERFORMANCE DATA

Basic Operating Conditions
Deviations in Operating Conditions
Approximate Over-All Dimensions
Recommended Condenser Sizes
Choice of Condenser Size
Condenser Data Charts
Condenser Dimensions
Condenser Friction
Circulating Pumps
Condensate Pumps
Other Auxiliaries

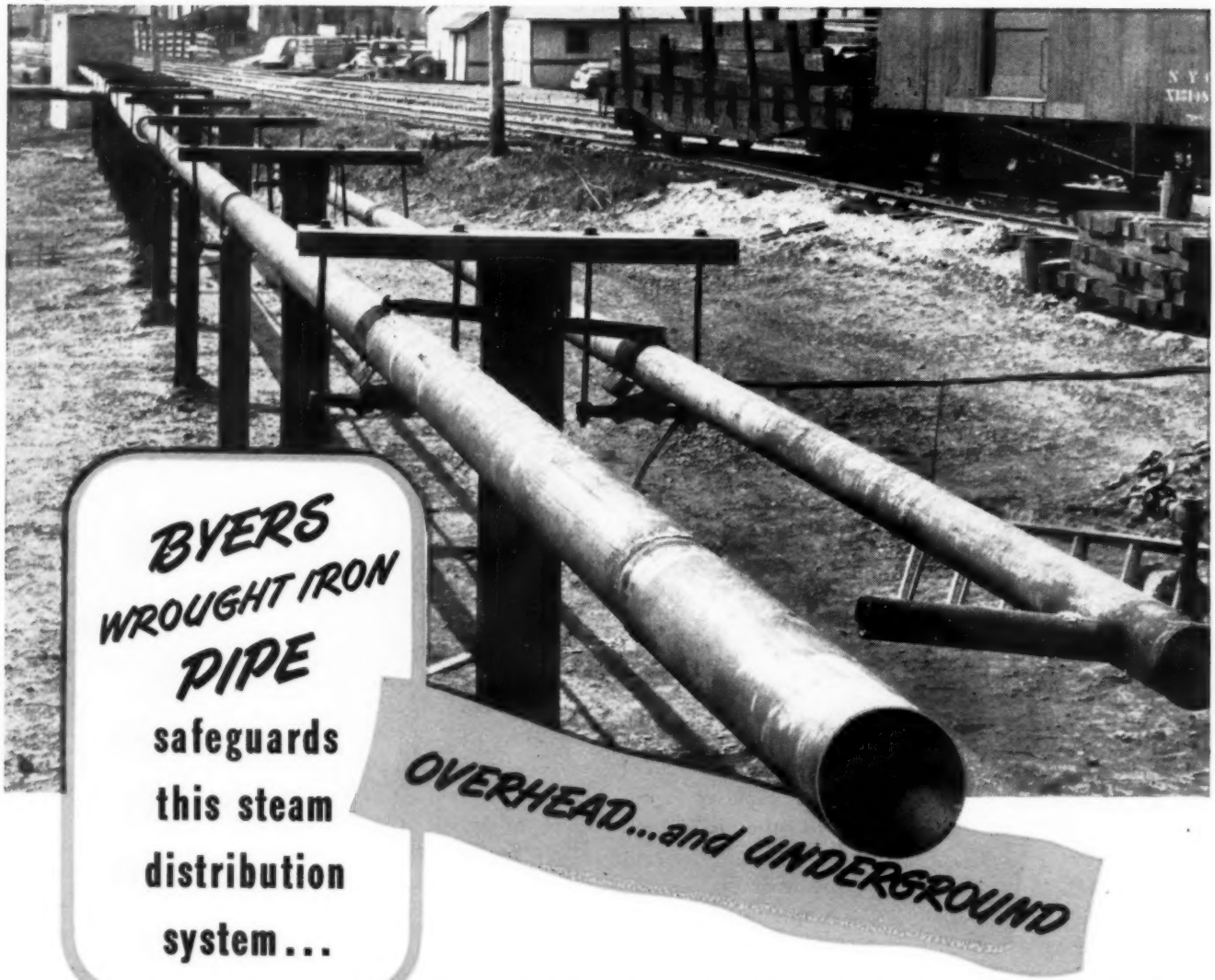
THEN YOU NEED THIS BOOK

This new Westinghouse Steam Power Plant Planning Guide contains basic information about condensing-type turbines from 10,000 kw to 60,000 kw . . . and the condensers suitable for them. Using this Planning Guide, you'll be able to trace the functional plan of your plant.

For a copy of this valuable new planning book, call your nearest Westinghouse Office. No obligation, of course. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-50457-A

Steam Headquarters



BYERS WROUGHT IRON PIPE safeguards this steam distribution system...

OVERHEAD...and UNDERGROUND

As every engineer knows, a steam distribution system meets a variety of corrosive conditions. Some attack can be expected from the steam. Condensate is invariably aggressive. Overhead runs are exposed to the weather, and underground sections are surrounded by humid atmospheres that create unusually severe service conditions.

A round-up of all these hazards to service life faced the extensive steam distribution system recently installed at Denison University, Granville, Ohio. The heating plant provides steam for widely scattered campus buildings so that several miles of pipe were required for the installation. Part of the run is overhead, the balance underground. The engineers followed a time-tried method of combatting the corrosion threat; they installed Byers Wrought Iron for all distribution system supply and return piping. The same material was installed in a number of other services: condensate piping in boiler house and buildings; domestic hot water piping, underground and in buildings; overflow and drain piping in boiler house; and boiler blow-off piping.

There is plenty of engineering evidence to support this choice of wrought iron. One classic example is an underground distribution system of 10" wrought iron pipe installed in Illinois shortly after the turn of the century. A few years later, a 16" wrought iron line was added. After 13 years use, the line was relocated. Only one length was badly corroded—and this was found to be low-first-cost material. The rest of the line was relaid and at last report, after 29 years of service, was still operating. No further maintenance had been required.

The reason for records like this is found in wrought iron's unique structure and composition. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and diffuse corrosive attack, and so discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

You will find some helpful information on eliminating repairs and maintenance in distribution systems in our bulletin, "Wrought Iron for Underground Services." We will be glad to send you a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • AUGUST 1946 • ESTABLISHED IN 1882

IT'S STILL EARLY

WE ARE IN THE BUSINESS of making power. It is our chosen job to burn fuel to make steam and electricity so industry can manufacture things people want. We expect to stay in the power business, which means that we are watching with greatest interest every detail of what our Navy, Army and Air Forces are doing with atomic energy, that potential new fuel that may (or may not) some day call for great changes in our methods of producing heat and other forms of energy.

Early radioed reports from Phil Swain indicate that there have been some odd reactions among observers of the Bikini tests. Some news reporters were surprised that the single bomb did not sink most of the 73 ships, that no tremendous noise shattered eardrums 20 miles away, and that the terrific heat did not sunburn watchers.

We think it fortunate that so many excellent scientific and technical eyes are watching these tests, too. And that there are many more like them here at home to help interpret what some have seen with their eyes and recorded with their instruments. It will be quite a while yet before the real results are digested and conclusions can be drawn about this new and almost untried energy source.

Just as newsmen cannot help but be disappointed if the world's greatest firecracker explodes' with a swish instead of a boom, there will come inevitable deflation of atomic energy as a new power source because it will not immediately be harnessed to autos, ships and generators. And the answer will be the same as at Bikini—it's still too early.

We have just finished "Atom-Year One," and just dropped the fourth atomic bomb. What the Navy learns about sinking or not sinking ships with atomic bombs, what the instrument charts show in little inked curves, and what shadows appear on photographic plates will become the basis for a thousand questions about using the atom to turn the wheels of the future.

Right now our primary job is to learn all we can about the atom and its behavior. From the Bikini tests, from the pilot power plant building at Oak Ridge, from a thousand laboratories the answers will come. Then, and only then, will we be ready for our real job. the infinitely complex one of putting atomic energy to useful application in a peacetime world.

EXCERPTS FROM PHIL SWAIN'S DISPATCHES SUMMARIZE BOMB DAMAGE

KWAJALEIN, July 5—The atomic bomb experiment on July 1 was well planned and executed. The bomb was of normal efficiency and performed as informed opinion had predicted. Those who expected the impossible—trees uprooted at Bikini Island three miles away or steel melted on ships a quarter mile away—were disappointed. Such unscientific expectations arose largely from failure to understand how rapidly all bomb effects must fade with distance. The much advertised "hundred-million-degree heat" was confined to the bomb's center and lasted perhaps a millionth of a second. This dazzling photoflash didn't melt even the thinnest aluminum foil or appreciably warm the ships. It merely gave them a skin-deep sunburn. Top paint coats blistered. Lower coats were untouched.

This flash didn't "burn up" anything except possibly on a ship directly beneath the bomb. It did start a few fires in highly inflammable materials.

Very likely the instantaneous pressure at the center of the bomb reached millions of psi but, again, distance did its work. On the cruiser Pensacola, approximately one-third mile from the burst, the blast pressure was only 5 to 10 psi. According to my horseback estimate, this would be enough to account for the collapse of the funnels of thin-gage steel.

All of the damaged ships I inspected showed the effect of a moderate blast pressure rather evenly spread over vast areas. Heavy structures, such as big funnels and turrets, were unscathed. More flimsy constructions, such as thin windbreaks, funnels, masts, were often bent and twisted. At one-third mile, rubber tires remained like new, and exposed jeeps could have been driven away. On the other hand, many airplanes on decks at greater distances were substantially blast damaged.

CONSOLIDATED EDISON Lays Plans

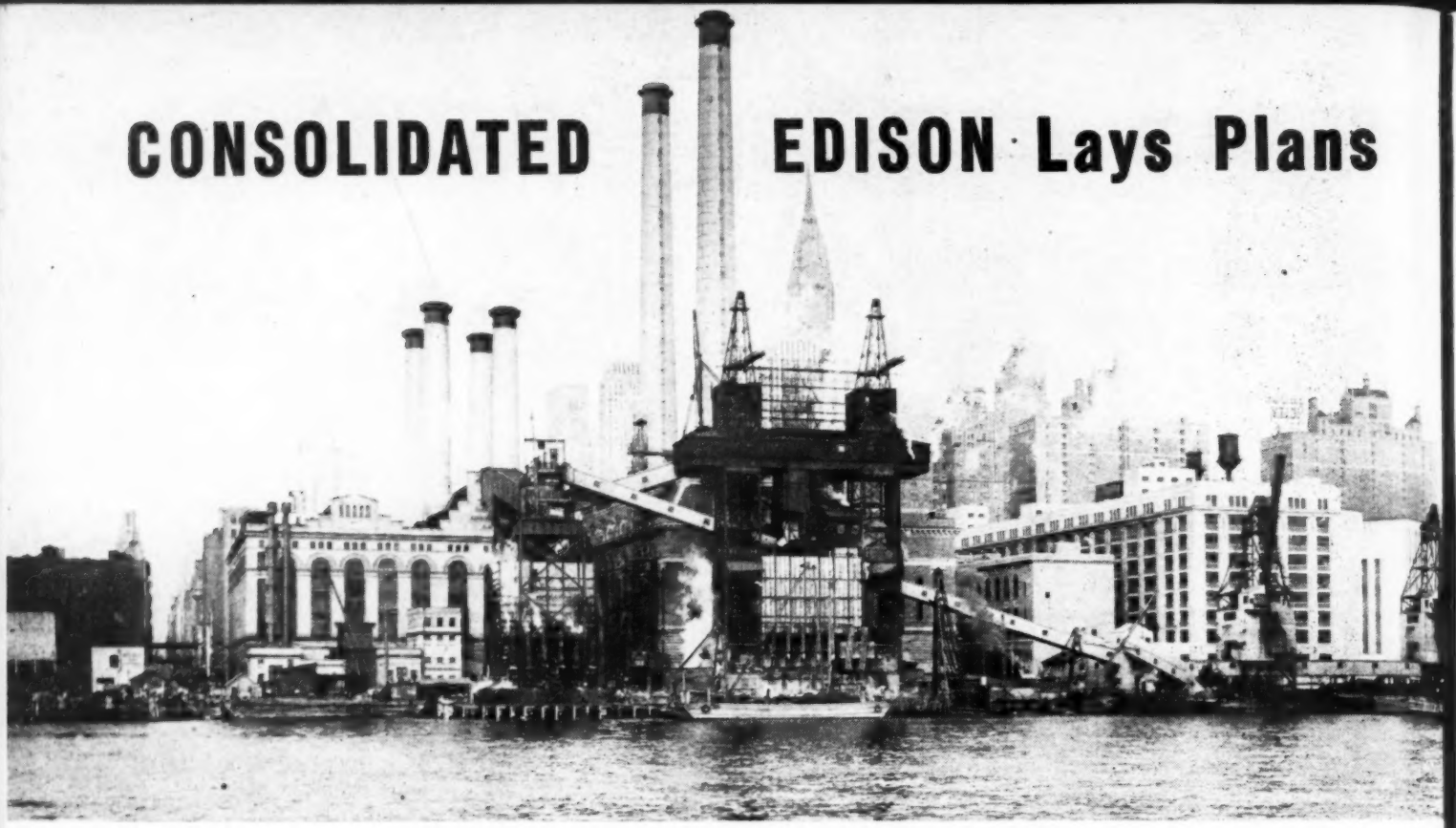


Fig. 1—Waterside Stations No. 1 and 2, on the East River in New York City, occupy the two blocks from 38th to 40th Street

Waterside Station follows complete cycle of development from steam engines through vertical steam turbines to high-pressure topping units. Station supplies district heating steam as well as electric energy at high economy as here described

By M J STEINBERG,
Division Engr, System Engrg Department
Consolidated Edison Co of New York, Inc

▶ WATERSIDE STATION HISTORY began in November 1897 when its erection was planned for the block bounded by 38th and 39th Streets, First Ave and the East River, New York City. This Station now known as Waterside No. 1 was initially under construction in December 1899. At that time capacity need was so urgent that during construction a temporary plant was installed consisting of a 200-kw De Laval turbine and a 500-kw Russell engine that operated noncondensing.

No. 1 Station went into service as a 25-cycle plant in the fall of 1901. Originally anticipated to be adequate for load increases to 1910, No. 1 had to be supplemented by another plant to supply the rapid growth that developed. No. 2 design was initiated in the summer of 1901 and went into operation in 1907. Since then both plants have operated as a single station through interconnecting steam and water piping and electrical cables, No. 2 being immediately to the northward of No. 1 between 39th and 40th Streets.

No. 1 Station. Original design of No. 1 Station contemplated installation of sixteen 25-cycle engine-driven 3800-kw generators of which eleven were actually installed. From 1904 to 1906 five vertical turbine-generators were added. In 1910 and 1911 four engine sets were replaced by three vertical turbine-generators rated 20,000 kw each. These units are still in service but will be removed in the present modernization program.

The remaining seven engine sets were replaced in 1918 and 1919 by two 35,000-kw horizontal condensing units. Two more such units replaced three of the original five vertical units in 1923 and 1924. Only changes to original 54 boilers on two floors were replacement of hand-fired grates with mechanical underfeed stokers and the addition of superheaters.

No. 2 Station. This station initially had two horizontal and eight vertical 8000-kw condensing-turbine units. Superheated steam was supplied by 92 hand-fired boilers on two floors. The generating units were subsequently equipped with forced ventilation and rerated at 12,000 kw each. Between 1912 and 1914 one 30,000-kw and one 22,000-kw horizontal condensing unit replaced the two horizontal units. Only change in the boilers was the replacement of hand-fired grates with mechanical underfeed stokers.

NO. 2 MODERNIZATION

From 1923 to 1934 no material station changes were made and No. 2 operated substantially as a 25-cycle plant. During this period the 25-cycle load declined and the 60-cycle load increased rapidly, dictating the need for additional 60-cycle capacity. In 1934 modernization of No. 2 made room for four high-pressure topping units and eight high-pressure pulverized coal-fired boilers by removing the 93 stoker-fired boilers and the eight vertical turbine-generators.

Initial installation consisted of two 53,000-kw 3600-rpm 60-cycle turbine-generators and four 500,000-lb-per-hr boilers operating at 1200 psig, 900 F. The final installation contained two 65,000-kw 3600-rpm turbine-generators and four 615,000-lb-per-hr boilers operating at 1250 psig and 925 F.

In conjunction with this development the 30,000-kw horizontal unit was rebuilt for 60-cycle service and its capacity increased to 40,000 kw. Two of the 20,000-

To Complete Waterside Modernization

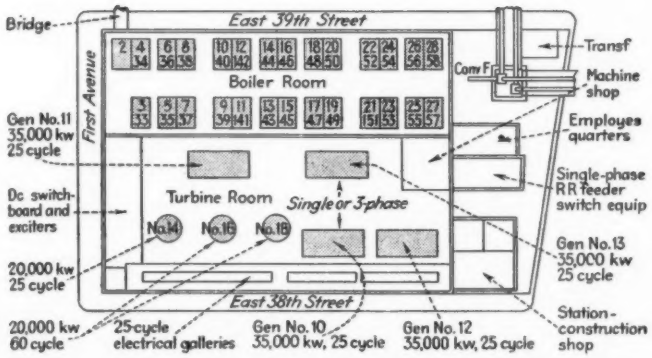


Fig. 2—Waterside No. 1 plan before initiation of development program shows seven turbine units, 53 steam boilers

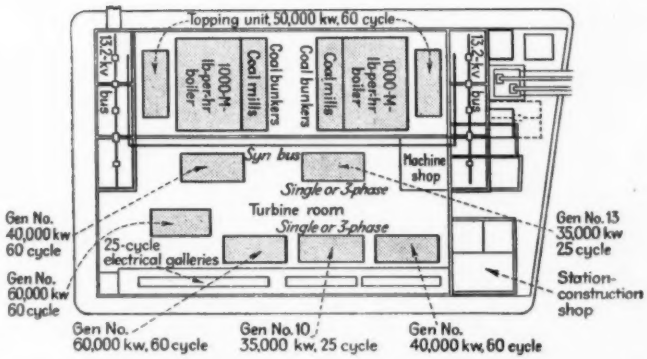


Fig. 3—Plan of ultimate development of Waterside No. 1 includes two 50,000-kw topping units and two new l-p units

kw vertical units in Waterside No. 1 were also rebuilt for 60-cycle operation and the two smallest verticals removed.

Waterside No. 2 modernization was completed in Sept 1941 with the initial operation of the fourth topping unit. Primary objective of this program was achieved by reducing the total 25-cycle capacity from 347,00 to 182,000-kw while concurrently increasing the 60-cycle capacity from 19,000 to 316,000-kw: total station capacity was increased from 336,000 to 498,000-kw.

NO. 1 MODERNIZATION

Initial modernization of No. 1 contemplates removing 37 of 53 low-pressure boilers to provide space for a single 1,000,000-lb-per-hr pulverized-coal-fired boiler supplying a 50,000-kw 3600-rpm topping unit at 1600 psig, 950 F. Three remaining vertical 20,000-kw units will also be removed to make room for two 60,000-kw turbine-generators operating with 200-psig steam. The two condensing units and high-pressure topping unit are scheduled to operate in the fall of 1947 and 1948 respectively.

Ultimate development of No. 1 contemplates a duplicate high-pressure topping unit in the space occupied by the remaining 16 low-pressure boilers. Fig. 3 illustrates the ultimate-plan layout.

Finally the rebuilding of two 25-cycle 35,000-kw condensing units for 60-cycle operation is planned, together with replacement of the remaining 25-cycle unit in Station No. 2 by a larger 60-cycle unit. The decision to modernize Waterside in this manner was reached after careful studies were made of the relative economics of high-pressure condensing and topping units. Upon program completion this station will represent the largest application of topping units.

The reasons for adopting this policy follow: (1) Topping units permit retention of existing efficient and relatively modern low-pressure condensing turbine-generators. (2) They serve as an efficient source of steam for the low-pressure condensing units, replacing relatively inefficient low-pressure boilers. (3) Although the cost per kw of topping capacity is greater than that for condensing capacity, the over-all station cost per kw, which includes the book cost of equip-

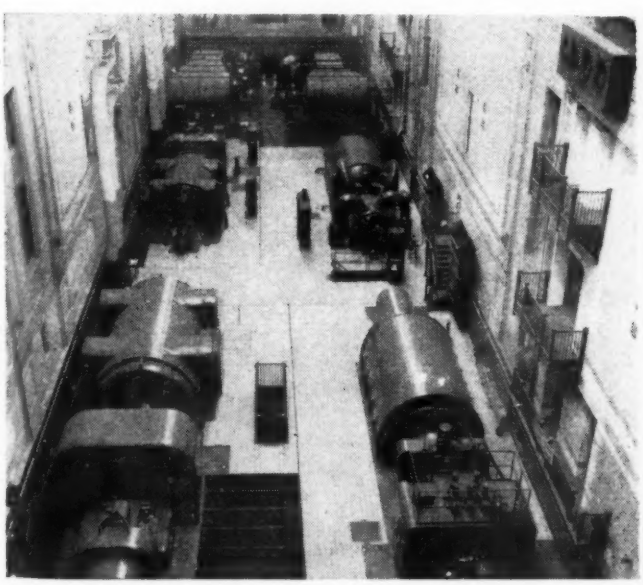
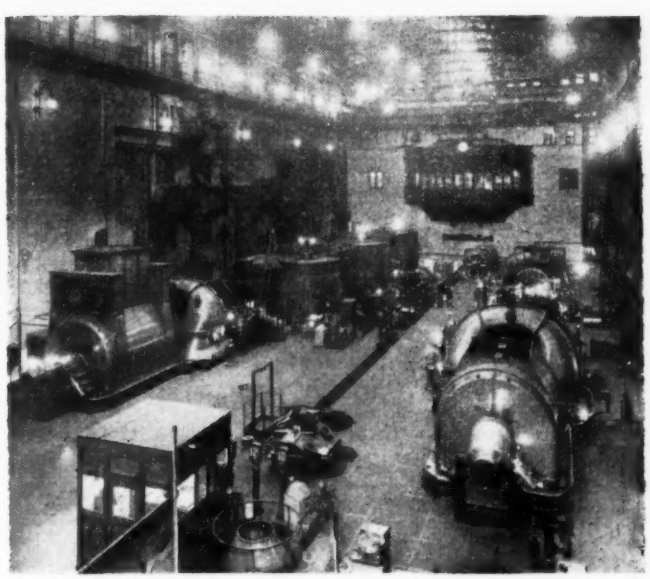


Fig. 4—Waterside No. 2 turbine room has two 53,000-kw 1200-psig 900-F topping units at center, two more in foreground rated at 65,000 kw, 1250 psig, 925 F each, all exhausting into station low-pressure steam header at 200 psig

Fig. 5—Turbine room of Waterside No. 1 shows in the far left corner three 20,000-kw vertical turbine generators to be replaced by two new 60,000-kw low-pressure units; compare with the station plan given in Fig. 2 and 3, above



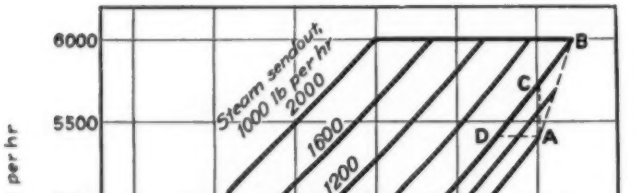


Fig. 6—Performance curves of Waterside Station relate total heat input and electric output for various rates of steam sendout. These hold for one combination of the units

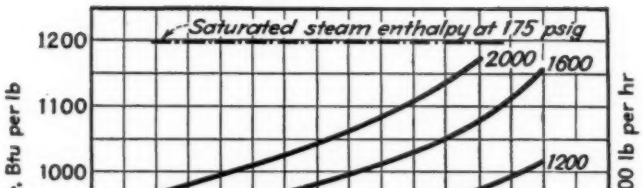


Fig. 7—Variation of steam-sendout heat rate at Waterside with change in system electric load and station steam sendout rate. Note that heat rate is less than steam enthalpy

ment retained, is comparable to the cost per kw of a condensing installation. (4) The over-all thermal efficiency of the topping cycle is not materially different from a condensing-unit cycle designed for the same initial steam conditions and final feedwater temperature. (5) With connections from Waterside to the steam-system distribution mains an efficient source of supply is provided at an average steam heat rate that is about two thirds of the heat rate at which steam can be supplied by the most efficient steam-system generating units.

WATERSIDE STEAM SENDOUT

The most efficient utilization of topping-turbine exhaust steam becomes possible by application of economy-loading principles. From Jan 1941 to Sept 30, 1945 about 35% of uptown Manhattan's district-heating steam requirements were supplied from the Waterside topping-turbine exhausts. Preliminary estimates show that on completion of the first step of No. 1 modernization this ratio may increase to about 60%.

Steam Heat Rate. It seems paradoxical that the average heat chargeable to each pound of steam delivered from the topping-turbine exhausts will be less than the steam enthalpy under certain conditions. A pound of saturated steam at

Table I—Calculation Of Steam-Sendout Heat Rate

For first 400,000 lb per hr at 2,000,000-kw system load

Points shown in Fig 6:	*A*	*B*	*C*	*D*
Steam sendout, 1000 lb per hr	0	400	400	400
Electric generation, 1000 kw				
Waterside Station	452	473	452	425
Other stations	1548	1527	1548	1575
Total	2000	2000	2000	2000
Change in generation, 1000 kw				
Waterside station	....	+21	0	−27
Other stations	....	−21	0	+27
Waterside heat input, 10^6 Btu per hr	5400	6000	5725	5400
Electric system incremental heat rate excluding Waterside, from Fig. 9, Btu per kwhr	....	16,260[a]	....	16,550[b]
Electric system heat-input change excluding Waterside, 10^6 Btu per hr	....	−341.5	....	+446.9
Waterside heat-input change, 10^6 Btu per hr	....	+600.0	+325	0
System heat input net increase, 10^6 Btu per hr	....	+258.5	+325	+446.9
Steam sendout heat rate, Btu per lb	....	646	813	1117

[a]—Average of incremental rates at 1548 and 1527 mw
[b]—Average of incremental rates at 1548 and 1575 mw
[c]—From Fig. 9 at the average for items 3 and 6
[d]—Item 11 × Item 12
[e]—Item 10 + Item 13
[f]—Item 14/1,200,000

Table II—Example of Steam-Heat-Rate Calculation

For 1,200,000 lb per hr steam sendout from Waterside

	1 System electric load, 1000 kw	*1500*	*1800*	*2100*
	Electric generation, 1000 kw			
	With 0 lb per hr steam sendout:			
2	at Waterside	452	452	452
3	at other stations	1048	1348	1648
4	Total	1500	1800	2100
	With 1,200,000-lb-per-hr steam sendout:			
5	at Waterside	418	418	418
6	at other stations	1082	1382	1682
7	Total	1500	1800	2100
	Waterside heat input's, 10^6 Btu per hr:			
8	with 1,200,000 - lb - per-hr sendout	6000	6000	6000
9	with 0 lb-per-hr sendout	5400	5400	5400
10	Incremental increase	600	600	600
11	Incremental heat rate at other stations, Btu per kwhr[c]	12,870	14,700	18,300
12	Incremental generation at other stations, 1000 kw	34	34	34
13	Incremental heat input at other stations, 10^6 Btu per hr[d]	437.6	499.8	622.2
14	Total heat chargeable to steam sendout, 10^6 Btu per hr[e]	1037.6	1099.8	1222.1
15	Steam sendout heat rate, Btu per lb[f]	865	917	1018

sendout pressure of 175 psig has an enthalpy of 1198 Btu, for which the average heat rate to date has been under 1000 Btu per lb.

Factors controlling the steam-heat-rate value are (1) levels of electric generation at Waterside and other electric-system stations (2) incremental heat rates for the electric-system plants and (3) combinations of equipment in service. Excepting the periods when electric loads are relatively light, the topping units operate at capacity output. For most ranges of high-pressure exhaust delivery to the steam system a reduction results in electric generation of the Waterside low-pressure unit. This reduction requires replacement by electric generation at other system stations and the heat of the fuel burned is chargeable to the Waterside steam sendout.

Fig. 6 shows the performance of Waterside Station in both electric generation and steam sendout. These curves apply to a particular combination of boilers and turbines purposely selected to show a condition where maximum electric generation cannot be produced without steam sendout, as at point *A*. To obtain maximum electric generation it is necessary to deliver 400,000-lb-per-hr steam sendout, as at point *B*. To illustrate the variation in sendout heat rate and the nature of the factors influencing it, a sample calculation is given in Table I for 400,000-lb-per-hr sendout at electric generations, indicated in Fig. 6 as points *B*, *C* and *D*. This calculation shows that best economy is attained by increasing the generation at Waterside as at point *B* with a corresponding decrease in generation at other stations, for the system load level assumed.

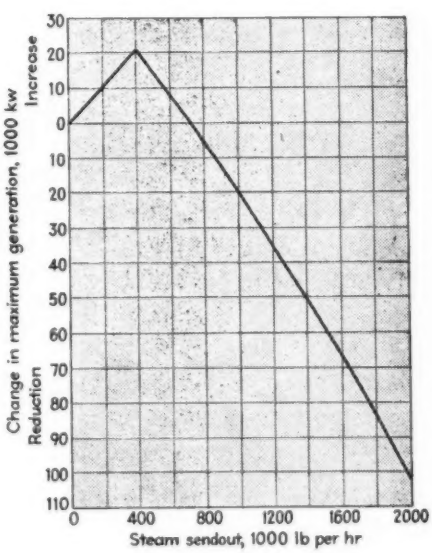


Fig. 8—With more high-pressure exhaust steam available than the low-pressure units can absorb electric generation at first increases with increased steam sendout, then decreases as steam is diverted from low-pressure-unit throttles

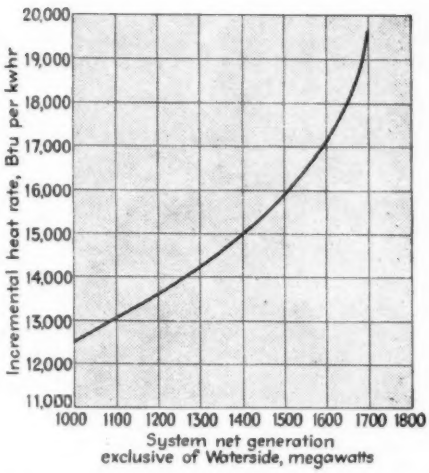


Fig. 9—Incremental heat rate of electric system exclusive of Waterside increases at an accelerating rate with an increasing load as more output is developed by the less efficient stations

Effect of electric-system load levels on the steam-sendout heat rate is shown by calculations in Table II for a sendout of 1,200,000 lb per hr. Fig. 7 gives variations for complete range of electric and steam loads. Change in electric generation at Waterside caused by steam sendout is shown in Fig. 8.

CAPACITY SAVING

It is well known that interconnecting two independent electric systems reduces the required total capacity because of pooling reserves and the peak-load diversity. This principle applies as well, if not better, to the inter-connection of a steam and an electric system. With reference to the Consolidated Edison System the peak electric demand generally occurs around 5:00 pm in December while the steam peak demand occurs in January or February between 9:00 am and 11:00 am. Steam- and electric-load characteristics are such that considerable advantage can be obtained from the diversity of demands. Since the electric demand is about five times the steam demand, interest naturally centers around the load-capacity needs at the time of the electric annual peak demand. To illustrate, the steam-and electric-load cycles are shown in Fig. 10 for a typical day during the peak season of 1945.

The loads have been reduced to clock-hour values and the steam loads to equivalent electric values to permit the presentation of a combined steam-electric load curve. The figure shows the combined steam-electric demand peak to be less than the sum of the independent peaks by an amount equal to 1,150,000 lb per hr. This means that with the Waterside steam connection the steam system can then operate on this particular day with 1,150,000-lb-per-hr less capacity than would be required if no steam connection existed.

In addition to capacity reduction because of load diversity, an additional reduction is possible by the pooling of reserves. When the systems operate independently each must provide operating reserve that is generally equal to the capacity of the largest unit. With interconnection the total reserve can be reduced as follows:

	Independent operation	*Combined operation*
Independent peaks:		
Steam	403 mw	
Electric	1998	
Total	2401 mw	
Coincident peaks:		
Steam		311 mw
Electric		1998
Total		2309 mw
Operating reserves:		
Steam	60 mw	0 mw
Electric	160	160
Total	220 mw	160 mw
Total capacity needed	2621 mw	2469 mw
Capacity reduction:		152 mw
From diversity[a]		1150 m lb per hr
From pooling[a]		750 m lb per hr

[a]—Based on 12.5 lb steam per kwhr.

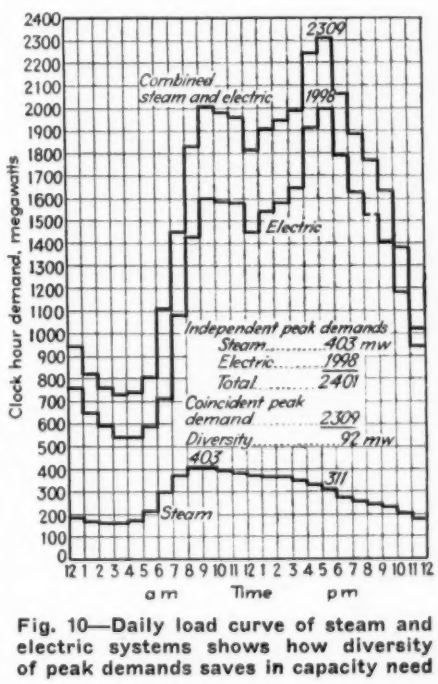


Fig. 10—Daily load curve of steam and electric systems shows how diversity of peak demands saves in capacity need

VISCOSITY: Most Important Property Of Lubricating Oil

Viscosity not only governs manufacture of lubricating oil, it also influences its application. C M Larson, chief consulting engineer, Sinclair Refining Co, defines viscosity and tells how it is measured and compared by standardized methods

► Viscosity is the most important property of a lubricant because it governs manufacture, specifications, application, film thickness, friction, equipment design, oil consumption and wear. Viscosity is the resistance offered by a fluid to relative motion of its parts. It designates the fluidity or body, also the flow rate of an oil or lubricant. Viscous resistance is a function of the time rate of internal slipping or distortion of an oil. A heavy-bodied oil is high in viscosity and is slow-pouring. The lower the viscosity, the more freely an oil flows and the lower is the drag on engine parts or rubbing surfaces. Viscosity is measured by observing the time in seconds required for a certain volume of oil to flow through an opening under stated conditions of head, orifice size, and temperature.

SAYBOLT VISCOSITY

The Saybolt Universal Viscosimeter is the standard American instrument for testing petroleum products and lubricants.

According to the American Society for Testing Materials Method (ASTM, D88-44) temperatures of 100, 130 and 210 F are generally used to determine viscosity.

The instrument consists of a tube in which a quantity of oil is brought to the desired temperature by a surrounding liquid bath, Fig. 1. The time in seconds required for exactly 60 cubic centimeters of oil to flow through an accurately calibrated outlet or orifice is recorded as the viscosity in Saybolt Seconds Universal, or ssu.

Viscosity of a given petroleum oil may be accurately determined at any temperature if the viscosity for the sample is known at any two temperatures. The two known points are plotted on a chart and a straight line drawn between them. Fig. 2 shows such a chart; the line is called a temperature-viscosity curve, and the viscosity at any temperature can be read from it. Charts (ASTM D341-39) for these curves are published by the American Society for Testing Materials. Points *A* and *B*, Fig. 2, are known viscosities and points *X* and *Y* are examples of two temperatures at which the viscosity value of the oil is desired for the temperatures indicated.

VISCOSITY INDEX

Certain types of oils thin out more rapidly than others as the bearings or engine heats up and the oil temperature rises, thus giving a thinner or lower viscosity at that higher operating temperature. The oil which loses viscosity or body faster with rising temperatures is

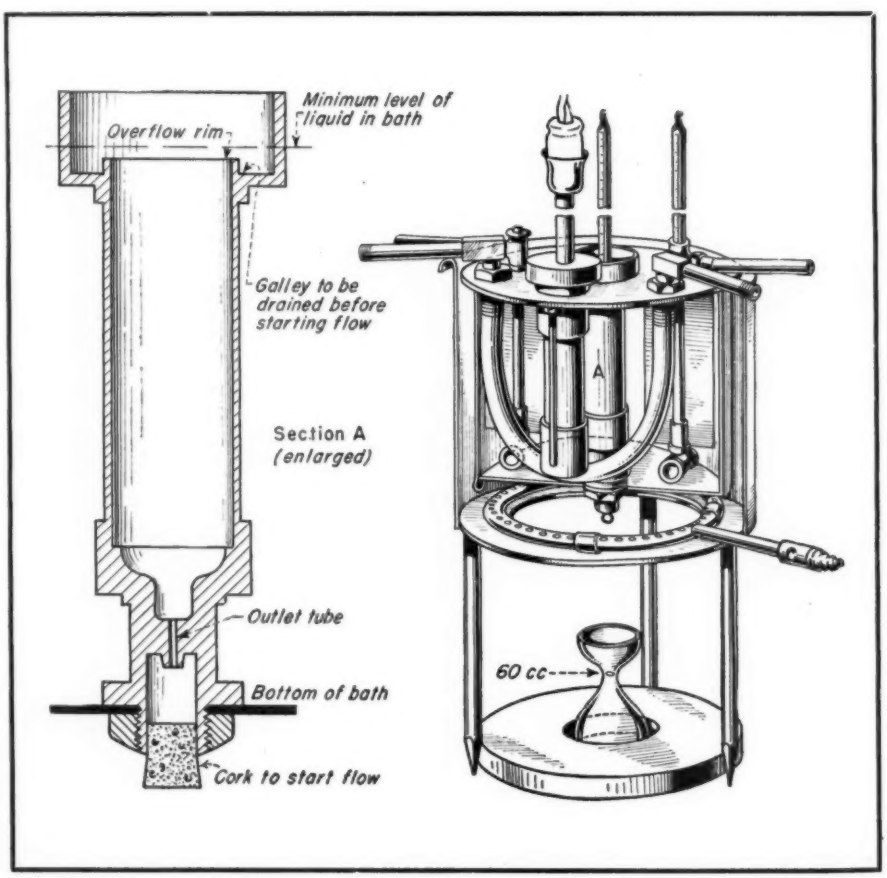


Fig. 1—Saybolt universal viscosimeter, the standard instrument for testing petroleum products and lubricants. Saybolt viscosity is the time in seconds for exactly 60 cc of the oil to flow through an accurately calibrated outlet or orifice

said to have a lower viscosity index, which is discussed in full below.

Lubricating oils made from various crudes change viscosity at different rates with temperature changes, as shown in Fig. 3. The relation as expressed by Saybolt viscosity at 100 F with respect to the Saybolt viscosity at 210 F for the different lubricants of a given crude oil is the viscosity index. Lubricants made from Pennsylvania crudes represent the least change in viscosity with temperature, and oils conventionally refined from naphthenic or Gulf Coast crudes represent the greatest change in viscosity with temperature. Mid-continent oils from mixed-base crudes are generally in between these two although solvent treating of mid-continent crude makes the temperature-viscosity relationship change and approach that of the Pennsylvania paraffin-base crudes.

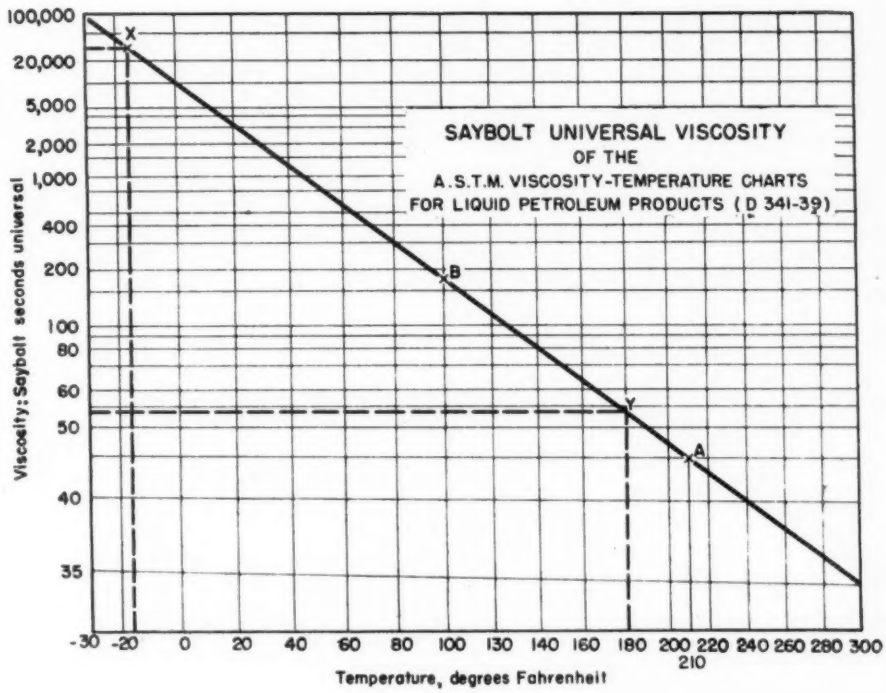


Fig. 2—Viscosity of a petroleum oil can be determined at any temperature if known viscosities are plotted on above chart and connected with a straight line

VISCOSITY CALCULATION

Calculation Method. Viscosity index (*V I*) is an arbitrary method of stating the rate of change in viscosity of an oil with changes in temperature. Simply stated, *V I* rating of any specific oil is obtained by a comparative evaluation of the specific oil, referred to as *U* in Fig. 3. with two standardized oils. One standardized oil, referred to as *H*, has been assigned a high *V I* value of 100 Saybolt seconds, which is typical of a conventionally refined Pennsylvania oil. The other, assigned a low *V I* rating of 0 seconds, is referred to as *L*, which is typical of certain conventionally refined Gulf Coast oils.

The viscosity of both the high and low *V I* standard oils must have the same value at 210 F as the sample. This is the basis for selecting the *H* and *L* standards. The *V I* of the sample is determined at 100 F although the standardized oils are selected by equal viscosities at 210 F.

INDEX FORMULA

V I of the sample is determined by a ratio set up by subtracting the viscosity of the sample at 100 F from that of the *L* (low standard) and dividing this amount by the value obtained by subtracting the 100-F viscosity of the *H* standard from the *L* standard and multiplying by 100. This is shown in word formula at bottom of Table II.

Method for calculating Viscosity Index. Table I, ASTM (D567-41) shows the viscosities at 100 F for *H* and *L* standardized oils; also (*L* — *H*) for different viscosities at 100 F. The viscosities shown at 210 F are those that might be normally encountered in industry. The average viscosity characteristics of these two standardized oils have been arbitrarily chosen and adopted by ASTM.

The *V I* for an unknown oil having a viscosity of 100 sec at 210 F was determined from the above stated formula and Table I. Results of the arbitrary method of determining *V I* are shown in Fig. 3. The dotted line in the center shows the rate of change in viscosity of the unknown sample with respect to the two standards.

Average *V I* values of lubricating oils conventionally refined from the better-

Table I—Method for V I Calculation, ASTM (D567-41)

Saybolt universal viscosity 210 F sec	*H*	*L*	*D (L—H)*
97.5	1138	2509	1371
98.0	1148	2536	1388
98.5	1158	2564	1406
99.0	1168	2591	1423
99.5	1179	2619	1440
100.0	1189	2646	1457
101.0	1210	2701	1491
102.0	1231	2757	1526
103.0	1252	2814	1562
104.0	1273	2870	1597
115.0	1510	3523	2013
116.0	1532	3585	2053
117.0	1554	3648	2094
118.0	1576	3711	2135
119.0	1598	3774	2176
120.0	1620	3838	2218
121.0	1643	3902	2259
122.0	1665	3966	2301
123.0	1688	4031	2343
124.0	1710	4097	2387

TABLE II—VISCOSITY INDEXES FOR VARIOUS OILS

As determined by word formula given at bottom of table

Source of crude	*Average V I, Regular refining*	*Average V I, Solvent treatment*
Pennsylvania	95–100	100–110
Mid-continent	65–75	80–100
East Texas	50–60	80–95
California	0–35	40–65
Gulf Coast	0–30	.....
Colombia	30–40	.....
Peru	15–25	.....

Viscosity-Index Word Formula

$$\text{Viscosity Index (U-sample at 100 F)} = \frac{\text{Viscosity (L standard at 100 F)—Viscosity (U sample at 100 F)}}{\text{Viscosity (L standard at 100 F)—Viscosity (H standard at 100 F)}} \times 100$$

known crudes, shown in Table II, p. 69.

Lubricating oils may be raised to a higher *V I* than normally obtained in refining, by the use of special addition agents.

When lubricating oils are subjected to very high pressure, above 10,000 psi—without temperature change—there is a marked viscosity increase. These conditions are found in hypoid gears and hydraulic systems. Paraffinic oils of high *V I* vary less with pressure than do Gulf Coast oils, and fixed oils vary least.

Lubricants with good temperature-viscosity curves (high *V I*) are desirable. In cold starting, the flatter the temperature-viscosity curve, Fig. 2, the less the energy required and the better the fluidity. In normal operation, and at high temperatures and pressures, the flatter temperature-viscosity curve oils have less friction and higher load-carrying capacity.

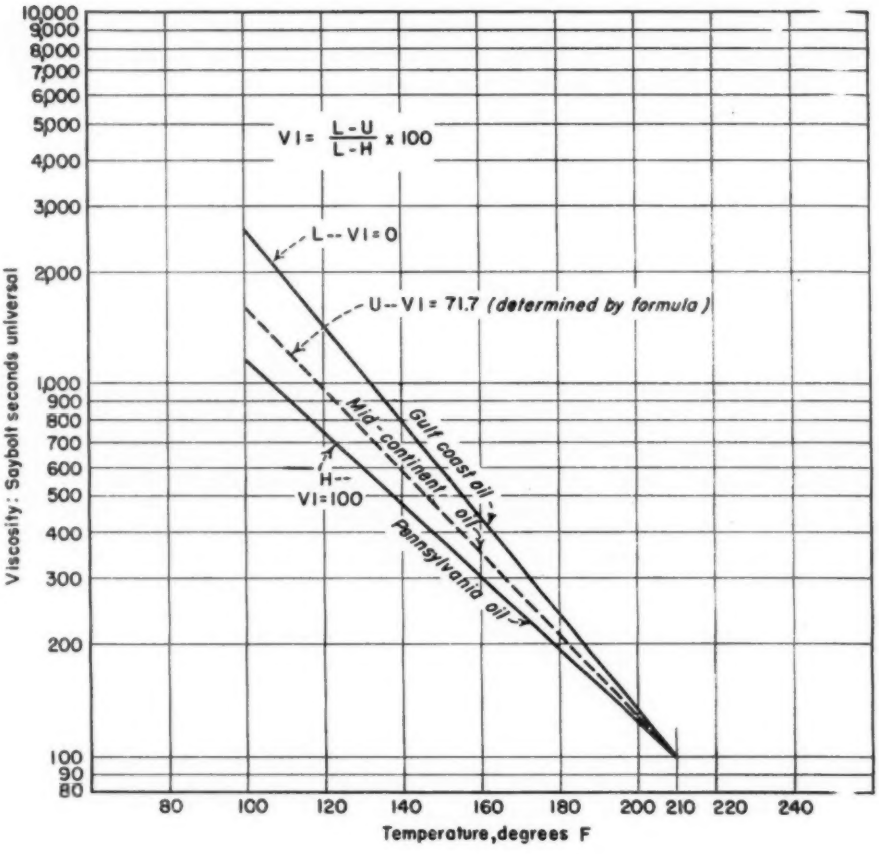


Fig. 3—Viscosity index or V I of an unknown oil (represented by dotted line above) is viscosity change based on comparative evaluation with 2 standards

Capacity of Mercury-Arc Rectifiers

▶ LOAD CAPACITY of mercury-arc rectifiers must be known to utilize them to fullest extent and best advantage. Knowledge of the factors affecting rectifier capacity and the relations between them has increased so that it is now possible to specify the rectifier capacity definitely.

Mercury-arc rectifier tubes (or tanks) are manufactured only in a limited number of types and sizes. A large variety of rectifier units of different ratings and characteristics may be made up from combinations of one or more similar tubes. Information regarding the capacity and characteristics of each tube (or tank) is essential to the design and application of such mercury-arc power converters. Before the American Institute of Electrical Engineers convention in Detroit, C C Herskind and H C Steiner, General Electric engineers, discussed the load-time and volt-ampere characteristics of typical mercury-arc tubes of the ignitron type, also the relations between these characteristics and other factors.

Load-carrying ability of a mercury-pool tube may be limited by arc-back, voltage surges, loss of control, structural failure, or other action. Of these causes, arc-back is generally the determining factor as it imposes a basic limitation on the rectifying action involving fundamental processes in the arc discharge. The limitation in rectifier capacity caused by arc-back is different in nature from thermal load limitations of most electrical machinery in that it usually results in an impairment in reliability rather than any permanent electrical or structural damage. Furthermore, it is somewhat indefinite because of the random occurrence of arc-back and the complexity and lack of full understanding of the arc processes.

Temperature rise does not provide a measure of the loading on a mercury-pool tube or indicate its probable life. However, the operating temperature of the tube does affect its capacity, as it controls the mercury-vapor pressure and establishes conditions for the arc discharge. Thermal limitations of essential components such as seals, studs and grids may also affect rectifier capacity, although such limitations are usually readily diagnosed and easily surmounted.

As with most electrical apparatus, time is an important factor in rectifier capacity, since short-time capabilities are different from those for continuous operation at a steady, sustained load. The time for a mercury pool tube to reach final temperatures is usually short because of the low thermal capacity of its parts. Furthermore, the time to establish conditions favorable to the occurrence of arc-back involves all the factors affecting the arc action, of which temperature is but one. For these reasons, relation between magnitude and duration of the limiting load of rectifier tubes differs materially from that for other types of conversion equipment. The authors believe the adoption of a standard form for specifying tube capacity would help application and operating engineers prepare specifications for tubes used in rectifier equipment.

Six of the World's Largest Pumps Protect Cincinnati Against Floods

Driven by 6500-hp synchronous motors, one-billion-gpd pumps with impellers 10 ft in diameter keep Cincinnati dry during Ohio River floods. Starting the pumps simultaneously with opening of the discharge gates introduced some unusual problems of control

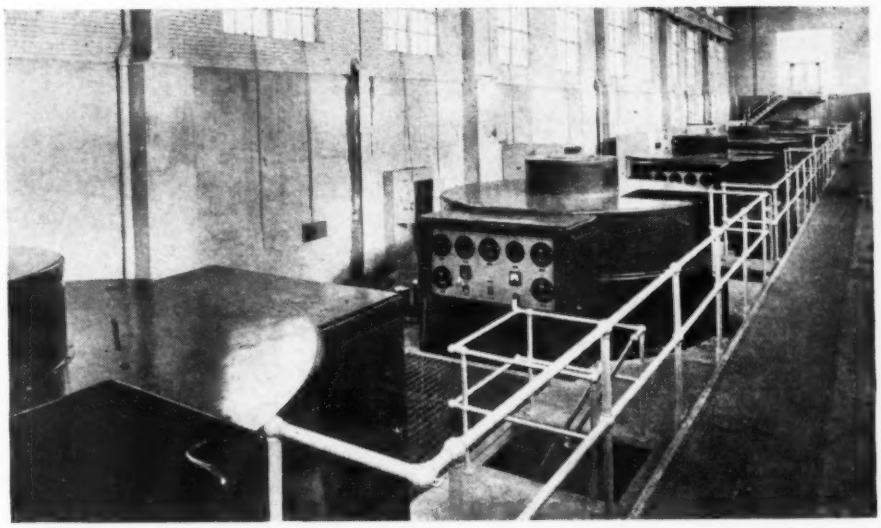


Fig. 1—Six 6500-hp 6600-v 180-rpm vertical-shaft synchronous motors with built-in gage boards drive the propeller pumps that discharge water over Mill Creek dam

▶ LIKE MANY OTHER CITIES Cincinnati, Ohio, has suffered tremendous losses from floods during recent years. Now it is being provided with flood protection that includes one of the largest-capacity pumping plants in the world.

Mill Creek flows south through the heart of the business district into the Ohio River. Along the creek's lower basin, subjected to high floods of the Ohio, are 40% of the city's manufacturing plants and much of its population. During the flood of January 1937, the Ohio rose 68 ft above its canalized-water level. This flood backed up Mill Creek valley and for many days a large area of the city suffered devastating losses by flood and by fire, which was fed by floating oil from overturned tanks.

FLOOD PROTECTION

Barrier Dam. Protection from such dangers in Mill Creek valley is now promised by the partly completed barrier dam across the creek near its confluence with the Ohio. This flood protection, designed and being built under supervision of U. S. War Dept engineers, required building a concrete-and-earth dam over a mile long through a heavily built-up, congested district, crossing 30 railway tracks and diverting many sewers into Mill Creek. Where traffic facilities pass through the dam, gates are provided for closure during flood periods. Normally the creek flows around the east end of the pumping plant. When the Ohio rises about 47 ft above low water, gates are closed in Mill Creek bypass, Fig. 2, around the pumping plant, and all creek flow is pumped over the dam.

Pumps for Present Pondage. The plant's six S Morgan Smith propeller pumps are considered sufficient to handle flood flows with Mill Creek's present pondage. In future if pondage is reduced by filling in part of the creek's storage basin, additional pumps will probably be needed to control flash floods. Space is provided for three more units.

These pumps are axial-flow propeller vertical-shaft type. Each 10-ft runner has four fixed vanes and discharges vertically upward through a 6-vane diffuser, Fig. 3. Pump capacity is probably the highest ever built for their type. They deliver more than their rated capacity, 1500 cfs (1,000,000,000 gpd) when there is less than a 29-ft differential between water level above and below the plant. With a 10-ft pool differential, pump capacity increases to 1850 cfs (1,188,000,000 gpd). An 18-in. shaft, 32 ft long, connects each pump to its General Electric 6500-hp 180-rpm synchronous motor, with a Westinghouse full-voltage automatic starter.

Discharge from each pump divides into two passages of siphon design. On the siphon's top a 9-ft-square radial gate controls each passage. Each gate connects to its own hydraulic-operating cylinder and piston through a piston-rod assembly. The hydraulic cylinders for the two gates on each pump have a common control and oil-and-air-pressure system, Fig. 5. Operating cylinders are on left- and right-hand sides of the figure, with the energy and oil-reservoir tanks just back of the control panel.

Having to start the pumps from a closed-gate condition created an interesting problem. If the gates were to remain closed until the pumps reached full speed, torque requirements would be excessive. The undesirable features of this starting were practically eliminated by arranging the controls to open the gates simultaneously with pump acceleration. This allowed for a more economical motor design that would meet the overall pump characteristics and, in addition, be within the requirements of the power system for full-voltage starting.

STARTING A PUMP

Pump Operation. Preparatory to starting a pump, oil in the energy tank is drawn down to lower end of lower gage glass. An air compressor that serves all

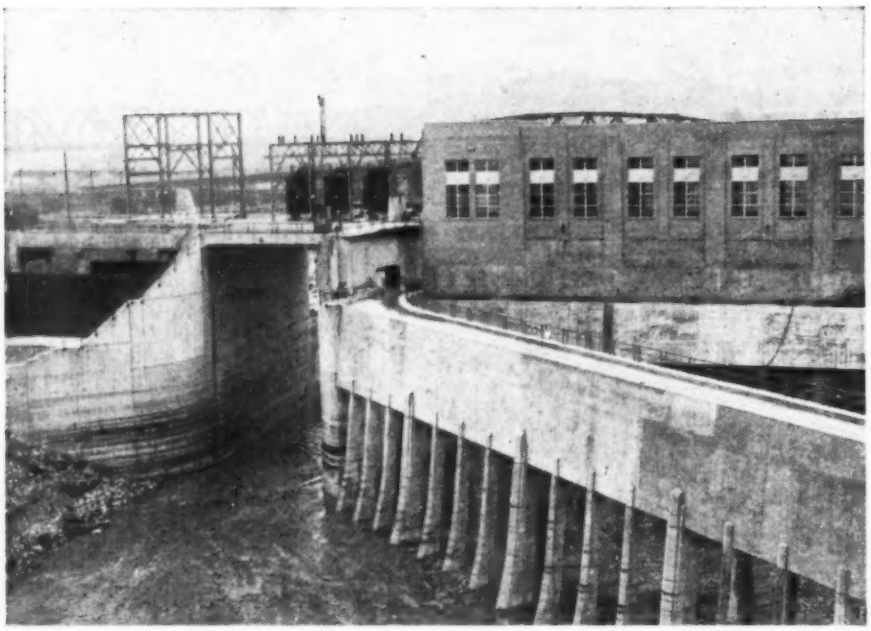


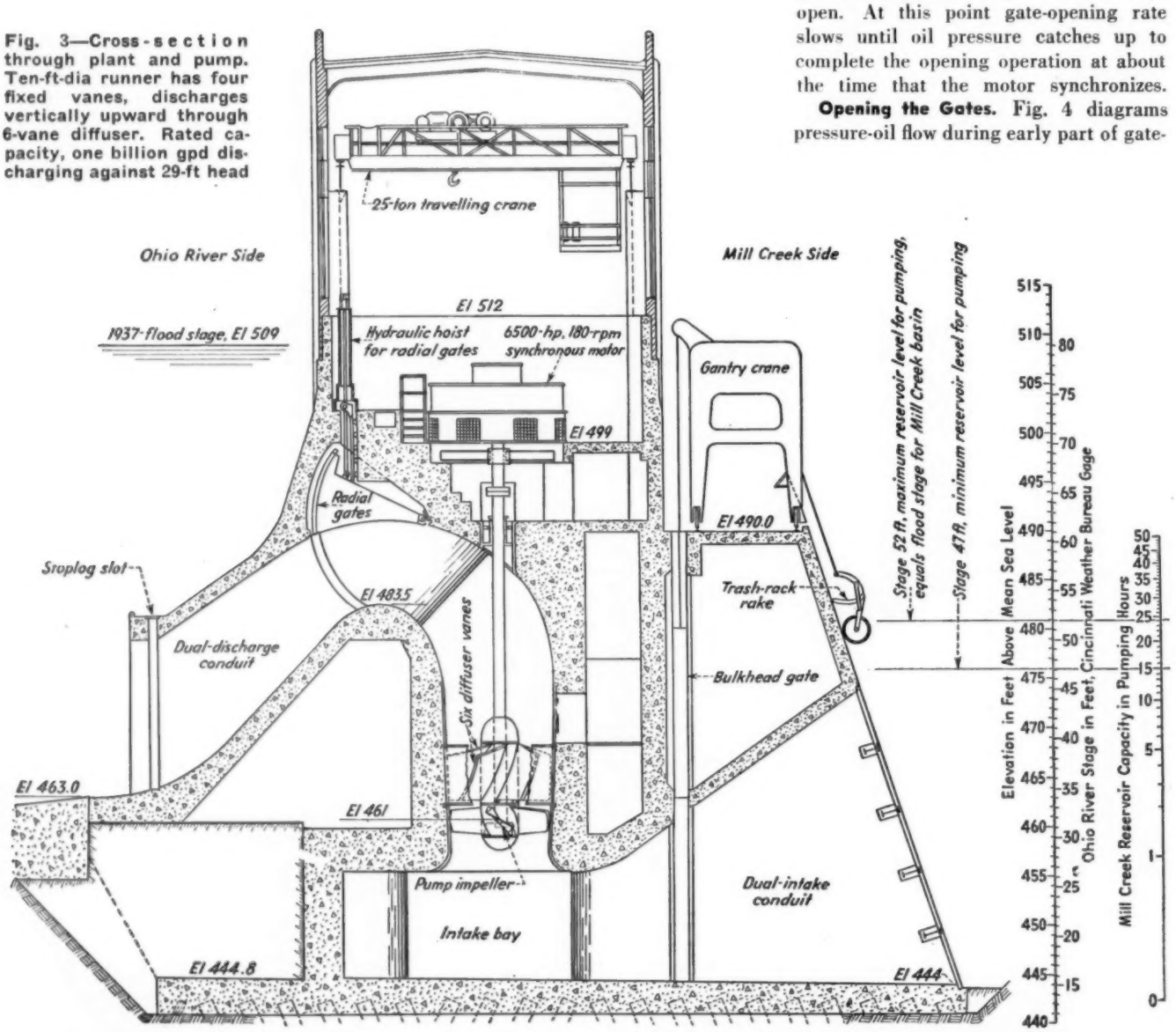
Fig. 2—Upstream side of barrier-dam pumping station. Normally Mill Creek flows around left-hand end of plant, but during floods creek flow is pumped over the dam

units fills the tank with 125-psi compressed air. Next the oil pump is started. It takes oil from the reservoir tank and discharges it against the air pressure into the energy tank until it is filled almost to upper end of top gage glass. Pressure in the energy tank, now about 500 psi as determined by automatic shutoff, is ready for starting the pump with discharge gates closed.

During a normal-service start, the motor's stator is connected directly to full-line voltage. Movement of the motor switch to the start position also energizes the solenoid-operated 3-way control valve to open the gates by admitting pressure oil below the gate-operating pistons. The motor accelerates and the gates open simultaneously. When the motor reaches near-synchronous speed the gates are about 25% open. By this time the pump begins to build up pressure against the gates to open them so rapidly that oil pressure lags until they are about 75% open. At this point gate-opening rate slows until oil pressure catches up to complete the opening operation at about the time that the motor synchronizes.

Opening the Gates. Fig. 4 diagrams pressure-oil flow during early part of gate-

Fig. 3—Cross-section through plant and pump. Ten-ft-dia runner has four fixed vanes, discharges vertically upward through 6-vane diffuser. Rated capacity, one billion gpd discharging against 29-ft head



opening operation. When the solenoid-operated 3-way valve opens simultaneously with closing of the motor switch it admits oil pressure below each gate-operating piston. Oil now flows from the energy tank to bottoms of cylinders and from their tops back to the reservoir tank. The flow-control valves' setting limits the rate at which the gate can open in this period. During the time that the gates open by buoyancy, pressure is higher above the pistons than below. As a result, flow from the energy tank ceases and oil discharges from the cylinders' tops back through check valves *C* to their bottoms. Setting of plug valve *P* now regulates flow. At the end of the buoyant-operating period, opening of the radial gate is completed by pressure oil from the energy tank, as during the first period.

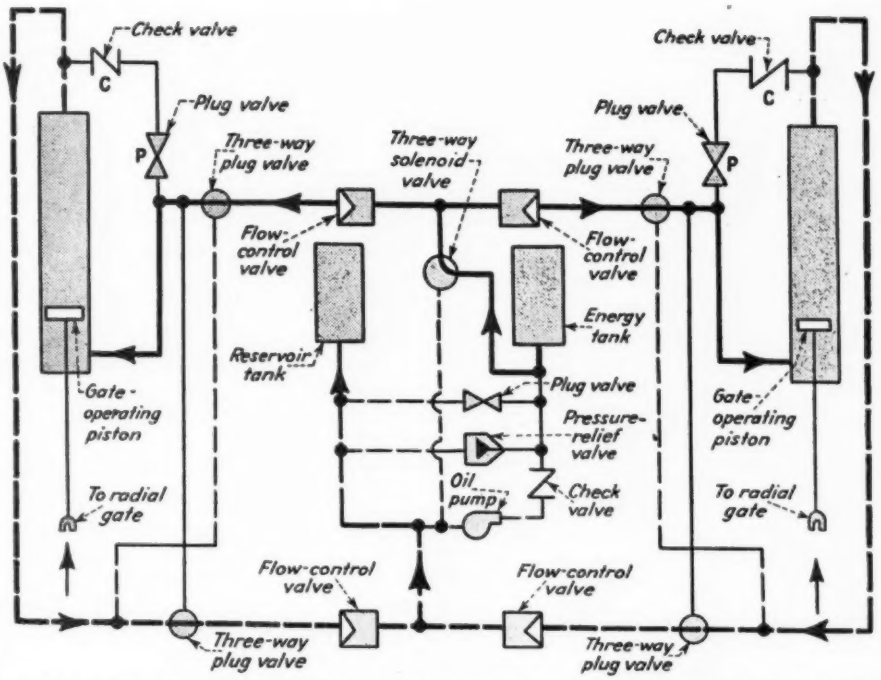


Fig. 4—Simplified diagram of hydraulic control and pressure system for opening the two radial discharge gates on one pump. Control is shown in opening position

CLOSING RADIAL GATES

Normally gravity closes the radial gates. When the motor-control switch moves to *off* position it releases the solenoid-operated 3-way valve and it returns to closing position. There the valve closes the energy-tank discharge and completes a flow path from the gate cylinders' bottoms to their tops.

If necessary, pressure oil from the energy tank can close the radial gates. This is done by turning the 3-way plug valves to connect the energy line to the cylinders' tops. These valves are also positioned to connect the cylinders' bottoms with the storage tank. Then, when the solenoid 3-way valve is placed in gate-operating position it applies pressure above the pistons to close the gates.

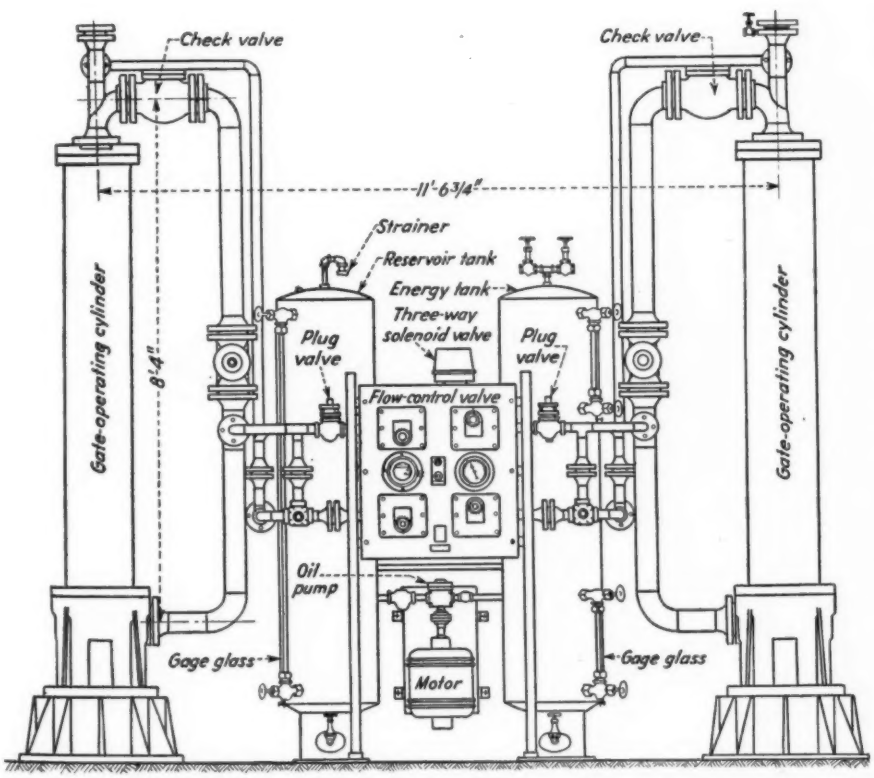


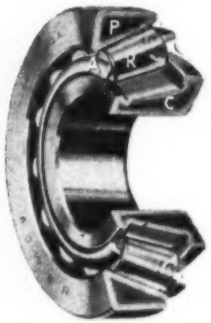
Fig. 5—Hydraulic system operates one pump's two radial discharge gates. Oil-reservoir and energy tanks are between the two gate-hoist cylinders, right and left

Synchronous Motors. The pumps' low speed and the large power required to drive them dictated use of synchronous motors, Fig. 1. These have torque characteristics specially tailored to start and accelerate the pumps to full speed. At the instant the motor switch closes, starting current reaches 500% normal full-load value, which is within the power system's capacity. On this the motor develops 67% rated full-load torque, but only about 25% is needed to overcome breakaway friction of the pump and its synchronous motor.

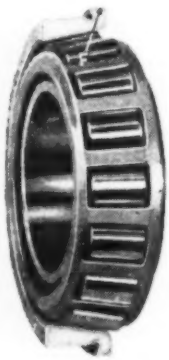
After starting, pump torque decreases to nearly zero, then rises rapidly until at 55% speed it reaches about 78% full-load value. If the radial gates remained closed, pump torque would equal motor torque of 110% at about 60% speed and prevent the pump being accelerated beyond this point. However, at 55% speed the radial gates have opened far enough to unload the pump, whose torque flattens out and remains well below 100% value until full speed.

Motor torque increases continuously as it accelerates until at 97% speed it is 150% of full-load value on 250% full-load current. Because pump torque is less than 100% the motor pulls into step quickly when the field switch closes automatically at an instant to produce maximum pull-in torque. Because of the large excess of motor torque over pump torque during starting, the pump is quickly brought to synchronous-motor speed without objectionable voltage disturbances on the power system.

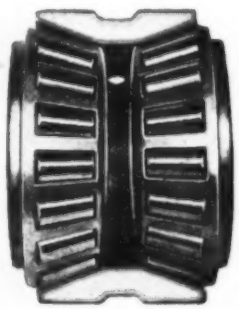
WIDE RANGE OF DESIGNS FIT ROLLER



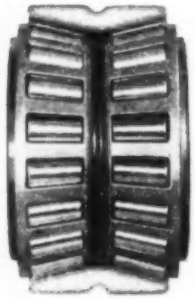
1 Single-row bearings are the commonest tapered roller in use



2 Flange F positions tapered-roller bearing in its housing



3 A double-cup tapered-roller bearing handles thrust loads



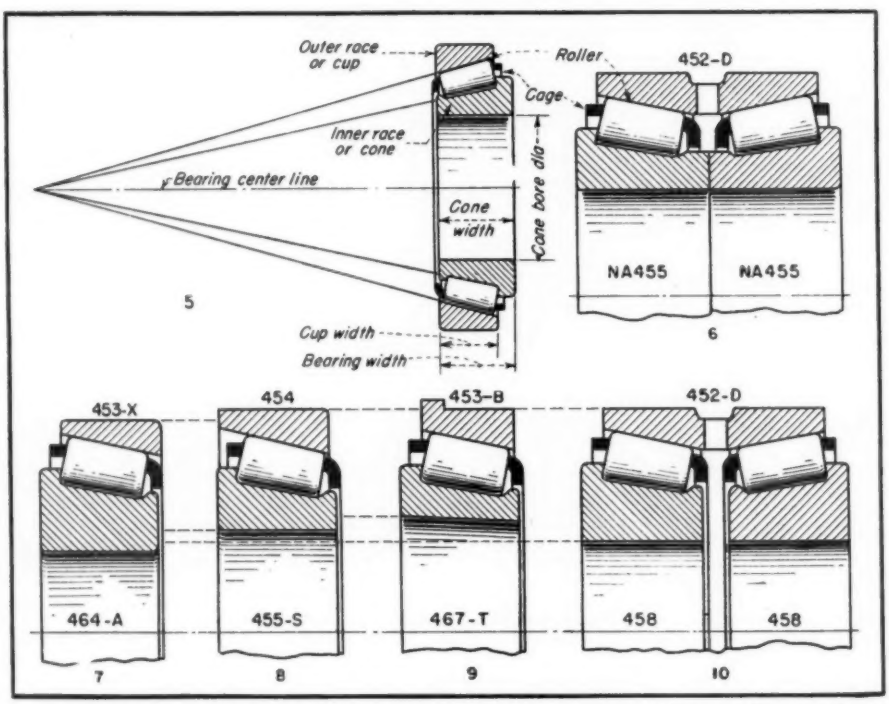
4 Nonadjustable bearing is an alternate for double-row design

A multiplicity of designs meet practically unlimited conditions of shaft loads and their directions, rotative speeds, space limits and other factors. C W Pearsall, vice-president, Ahlberg Co, discusses selection of the best design for each duty

► ANTIFRICTION BEARINGS may be divided into two groups: ball and roller. Ten ball-bearing designs and their applications were described in POWER, May, p 95. Here a similar job is done on roller bearings, which fall into four general classes: tapered, square, journal and needle rollers. Each is available in designs suited to specific applications.

Tapered-Roller Bearings. Working surfaces of a tapered-roller bearing's cup, cone and rollers are tapered to give a true rolling motion. Lines drawn through the contacting surfaces between cone and rollers and cup and rollers meet at the same point on the bearing's center line, Fig. 5. A shoulder or flange on the inner race keeps rolls properly aligned. Its tapered construction gives the bearing high thrust capacity in one direction combined with high radial capacity. Also, any radial load creates a thrust reaction that must be taken by another tapered-roller bearing mounted in opposition. Therefore, except for unusual applications tapered-roller bearings are mounted in pairs and take heavy thrust in either direction.

The term, cone, refers to cone *C*, rolls *R* and cage *A;* these parts with cup *P* make up a self-contained unit, Fig. 1. Tapered-roller bearings are divided into groups, called series; each is assigned a basic series number, which has no significance except as identification. Each size of cup and cone has its own number, which is a variation of the basic series number. Each number must be known to identify a complete bearing. Be sure to specify both numbers when ordering. All bearings in any one given series have the same size rolls, cage and inter-



5 Tapered-roller bearings are designed to give a true rolling motion in their races. 6 to 10 These diagrams show some combinations of tapered-roller bearings

BEARINGS TO EACH APPLICATION.

nal construction, as in Fig. 7 to 10.

Cups and cones in a series may vary as to external dimensions, but since internal dimensions are the same, any cup may be used with any cone in a given series. Thus, load capacity is the same for any combination of cups and cones within a given series, except a double-row bearing which has twice the capacity of a single-row.

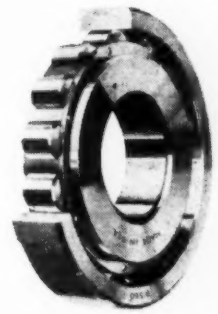
To illustrate interchangeability, Fig. 6 to 10 show possible combinations in the 455 series. Any cones can be used with any cups except *NA* cones, Fig. 6, which will not combine with a single cup. All major manufacturers of tapered-roller bearings use identical numbers for equivalent bearings.

Single-Row Bearings. Commonest tapered-roller design is the single-row bearing, Fig. 1, consisting of a single cup and a single cone. Since it takes thrust in one direction only and has a thrust reaction in the opposite direction when a radial load is imposed upon it, it must be used with another tapered-roller bearing mounted in opposition. This design is suitable for (1) heavy radial loads (2) heavy thrust loads in one direction (3) moderate speeds.

Fig. 2 shows a variation of the single-row bearing, Fig. 1. A flange on its cup positions the bearing in its housing and thus eliminates need for a shoulder in the latter. This facilitates boring cup seats at each end of the housing which are aligned with each other; both seats can be bored at one operation. This construction is especially desirable for machine tool spindles. Flange strength is greater than the bearing's thrust capacity. It is suitable where: (1) space limitations prohibit housing shoulders (2) it is desirable to through-bore the bearing's housing.

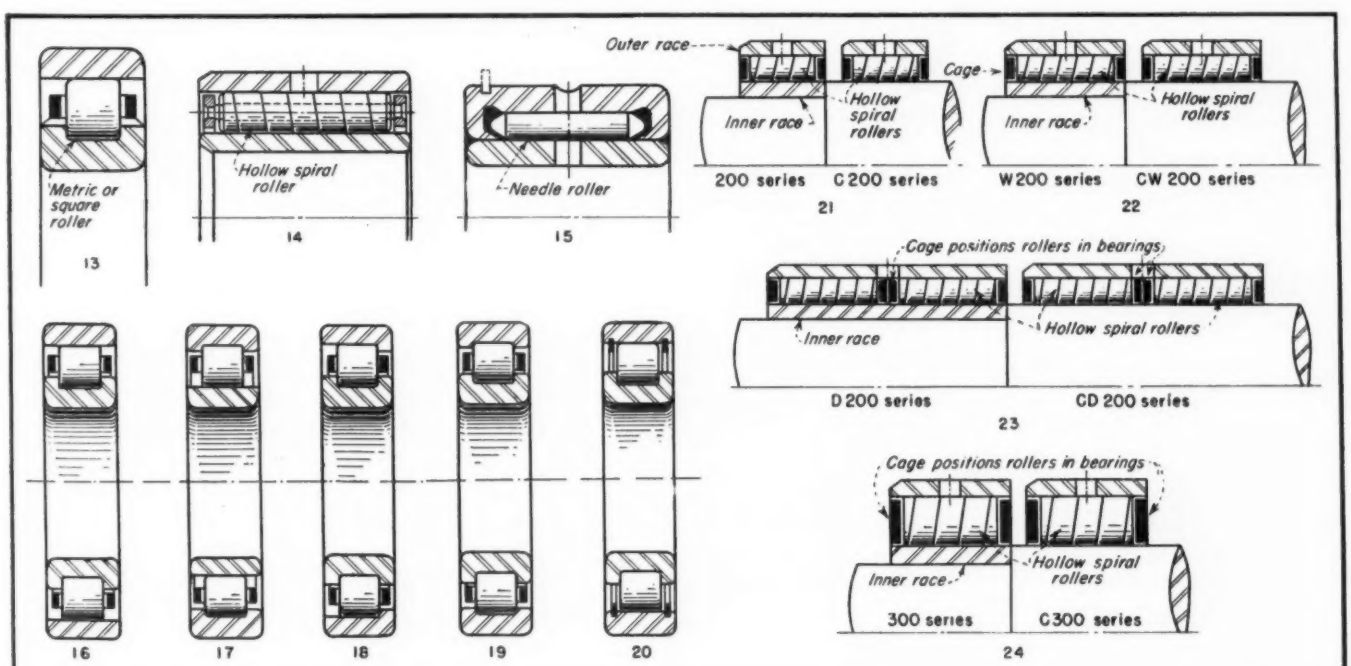
Double-Cup Bearings. A double-cup bearing consists of a double cup having two raceways and two single cones, Fig. 3. It can thus handle thrust in either direction so any type bearing may be used at the shaft's opposite end, which is not true of a single-row bearing. There is sufficient clearance between the two single cones to permit adjustment. Applications of this bearing are: (1) for extra-heavy radial loads (2) for heavy thrust in either direction (3) where bearing must float in its housing (4) where extreme axial and radial rigidity is required (5) for moderate speeds.

The *NA* or nonadjustable bearing, Fig.



11 Square-roller or metric bearing with inner and outer races

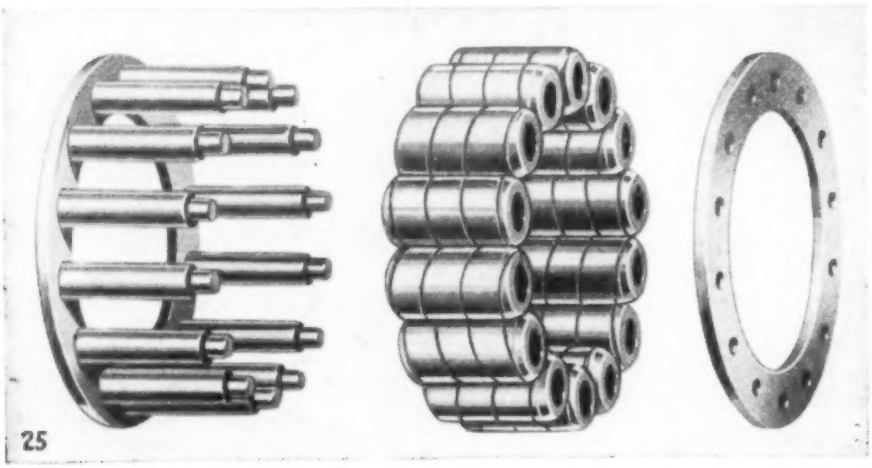
12 Straight-roller bearing without inner race runs on its shaft

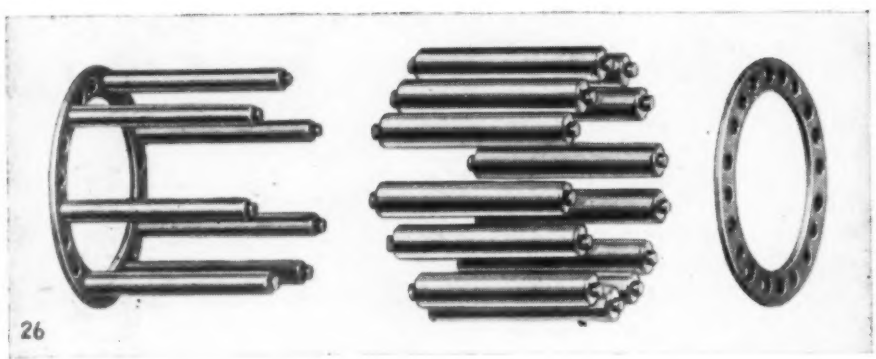


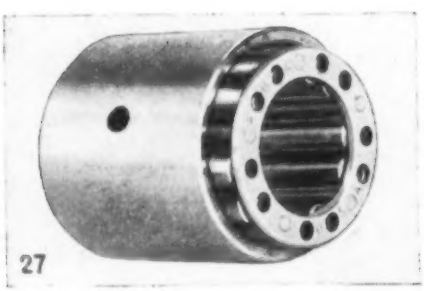
13 to 15 Cross-sections of square-, journal- and needle-roller bearings. 16 to 20 Arrangements of square-roller bearings. 21 to 23 Journal bearings, 200 series are in three widths. 24 Medium or 300-series journal bearing

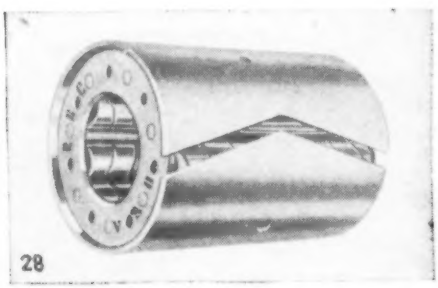
4, is an alternate construction of the double-row design. The same double cup is used but the single cones are wider so their faces butt together. Thus there is no room for adjustment and internal clearance is determined at time of manufacture. Applications are for bearings not to be adjusted when they are (1) installed in the machine or (2) replaced in service.

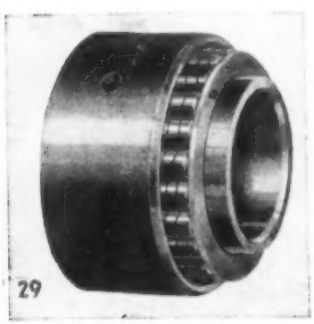
Straight-Roller Bearings. While there are many varieties of bearings using straight rollers and many special and unusual designs and applications, three major kinds are in general use. Fig. 13 to 15 show cross-sections of the three types. Metric or square-roller bearings, Fig. 13, are so-called because their rollers' length and diameter are about equal. They are commonly made to metric dimensions as are ball bearings. In journal-roller bearings, Fig. 14, rollers are much longer than their diameter. Rollers may be solid or a hollow spiral wound from a strip of steel, as in the figure. The third group, Fig. 15, are known as needle bearings because rollers have small diameter in relation to their length, and generally do not have a cage.

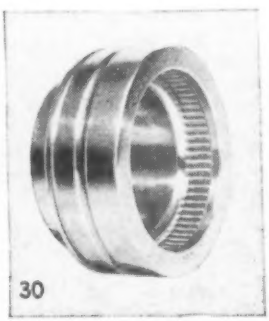

25

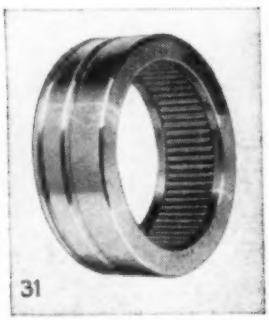

26


27


28


29


30


31

25 Parts of spiral-roller-bearing assembly. 26 Parts of solid-roller-bearing assembly. 27 Solid outer race is a hardened and ground cylinder. 28 Outer race is split so it can be sprung into its housing. 29 Heavy-duty journal bearing with spiral rollers and inner race. 30 Needle bearing with hardened and ground inner race. 31 Needle bearing without inner race designed to run directly on the shaft

SQUARE-ROLLER BEARINGS

Metric or square-roller and single-row ball bearings generally have the same external dimensions and are interchangeable as far as dimensions are concerned. However, as with all straight-roller bearings, these are suitable for radial loads only. Fig. 16 to 20 show various internal construction arrangements commonly available. Fig. 16 is the standard design with a straight-cylinder outer race without lips or shoulders. Inner race has lips to guide the rolls. In this design the inner race positions the bearing on the shaft, but bearing can float in its outer race to compensate for shaft expansion.

Fig. 17 shows a modification of Fig. 16 in which the rolls are guided by lips on the outer race, the inner one being a straight cylinder. Therefore the outer race positions the bearing in its housing and the inner one permits float to take care of shaft expansion. The bearing, Fig. 18, has one lip on its outer race and two on its inner; consequently shaft movement is limited to one direction, but it has same radial-load capacity as Fig. 16 and 17.

The lipped design, Fig. 19, has two lips on its inner and outer races to position the shaft in both directions. It has fewer rolls than the standard bearing, Fig. 16, consequently less radial capacity. In the full-roller design, Fig. 20, the outer race has snap rings to keep the bearing from coming apart. Two lips on the inner race guide the rolls and fix the bearing on the shaft. It has no retainer but has a full complement of rolls, which gives the bearing greater capacity than a standard design, but lack of a retainer limits its speed.

Journal-Roller Bearings. Journal-roller bearings consist of two or three separate units, an outer race, a roller assembly and sometimes an inner race. Without an inner race the rollers run directly on the shaft. Outer race is cylindrical and may be split or solid, with either solid or spiral rollers. The

(*Continued on page* 144)

Fan Laws Simplify Performance Calculation

For fans of similar design, performances can be calculated for various operating conditions provided the data on one running point are available. Here are given the derivation of the fan laws and their application to some illustrative plant problems

By R D MOYER, *Buffalo Forge Co*

▶ ALL FAN-PERFORMANCE CALCULATIONS are based on a few so-called fan laws. In this article these laws are derived and their application illustrated with examples of interest to both power-plant operators and designers.

Fan Laws. The basic laws apply only to geometrically similar fans and to similar points of rating. Geometrically similar or homologous fans all have the same angles and proportions. Each fan in such a series is a larger or smaller replica of all the others. Similar points of rating can be defined by studying the performance curves in Fig. 1a and 1b. Here the points of operation are marked by dashed lines. Note that fans are operating at the same point on their efficiency curves, the same percentage of free-delivery (FD) capacity and the same percentage of shut-off or no-delivery (ND) pressure. Similar points of operation or rating always fulfill these three conditions. This concept will become clearer after studying the fan-calculation examples shown later.

Derivations. Width and height of any fan outlet are each proportional to the fan wheel-diameter. The outlet area equals the wheel diameter squared times a constant, that is, $A_o = KD^2$. Also $Q/A_o = V_o$, fan-outlet velocity. See top of page 79 for nomenclature used in the formulas.

The wheel peripheral speed is $V_p = \pi DN$; then $V_o/V_p = (Q/A_o)\ (1/V_p) = (Q/KD^2)\ (1/\pi DN) = (1/K)\ (Q/\pi D^3 N)$. Another characteristic of similar points of rating is that V_o/V_p is always constant. Therefore, $Q_1/D_1^3N_1 = Q_2/D_2^3N_2$, or $Q_1/Q_2 = (D_1/D_2)^3 \times (N_1/N_2)$. This means that if fan size and speed are changed capacity varies directly as cube of the size and first power of the speed.

Next, find out how pressure varies with a change in fan size and speed. In any centrifugal machine pressure developed varies as square of the rotor-tip speed, or $P = KV_p^2$. For similar fans $P_1/P_2 = K\ (V_{p1}/V_{p2})^2$ and since $V_p = \pi DN$ it follows that $P_1/P_2 = (D_1/D_2)^2 \times (N_1/N_2)^2$, which means that if fan size and speed change, pressure varies as the square of both size and speed.

Fan horsepower is calculated by $Hp = 0.000157QP/\text{efficiency}$. Now, for same point of rating, which means also at the same efficiency, it is evident that $Hp_1/Hp_2 = (Q_1/Q_2)\ (P_1/P_2)$ and substituting for the last two ratios from the previously determined relationships it develops that $Hp_1/Hp_2 = (D_1/D_2)^5 \times (N_1/N_2)^3$. Thus horsepower varies as fifth power of the size and third power of the speed.

In addition to size and speed variations the gas density can also change. For a gas-density change, the cfm handled remain constant but the pounds of gas vary accordingly. Pressure developed by a fan originates from two sources (1) a gas compression by centrifugal force as it passes through the rotor and (2) a change of part of the gas kinetic energy into potential energy (pressure energy) in the fan scroll. As both centrifugal force and kinetic energy are proportional to density it is evident that the fan pressure is also proportional to the gas density. The horsepower will also be proportional to the gas density as capacity remains constant for a given fan speed.

These relations of fan performance factors are summarized, Fan Laws, p. 79.

Speed Change. As the first illustration of fan-law use, let's find the delivery of a No. 9 fan at 1200 rpm when its characteristics at 1080 rpm are 53,000-cfm rating, 500-F gas against 10-in. static pressure, as shown in Fig. 2. Law *a* from the table applies. Then:

$Q_2 = 53{,}000\ (1200/1080) = 58{,}900$ cfm, and
$P_2 = 10\ (1200/1080)^2 = 12.35$-in. static pressure, and finally
$Hp_2 = 111\ (1200/1080)^3 = 152$ hp at 500 F.

The 1200-rpm curves of Fig. 2 are drawn by applying the appropriate law to various points on the 1080-rpm curves.

System Resistance. Note the dashed curve that runs through the ratings at both speeds; this is a system-resistance curve. Every system through which gas passes has such a curve, independent of the connected fan. These curves are based on the pressure required to force gas through a system varying as the flow

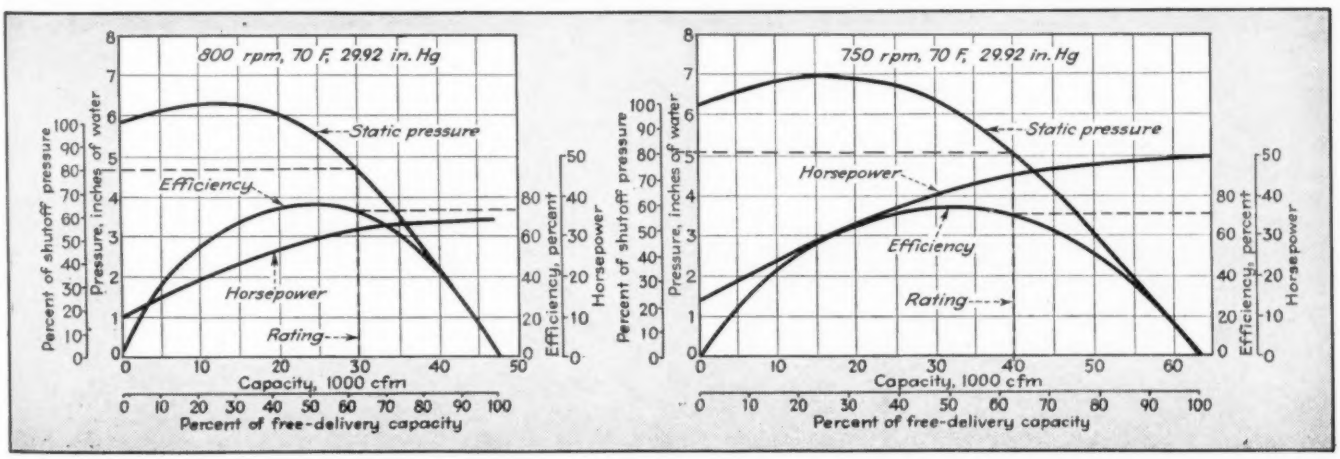


Fig. 1a—Set of performance curves for a No. 8 fan rated at 30,000 cfm of 70 F, 29.92-in.-Hg air when operating at 800 rpm. Fig. 1b—Performance curves of No. 9 fan rated 40,000 cfm of 70 F, 29.92-in.-Hg air running at 750 rpm

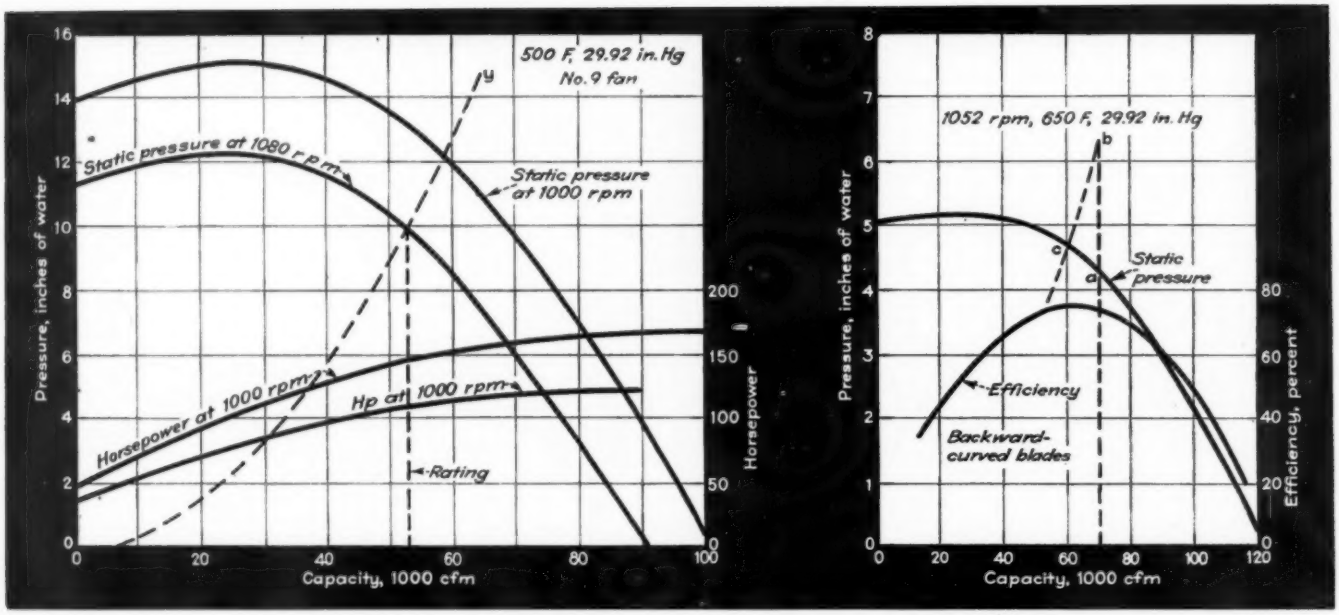


Fig. 2—Fan performance at different speeds can be readily computed when the characteristics at one speed are known

Fig. 3—When system resistances change from anticipated values the fan delivery will be correspondingly altered

squared. Thus, if flow doubles, required pressure will be four times that for original cfm. A fan with dampers wide open always operates at the point where system-resistance curve crosses the fan static-pressure curve.

Understanding the system-resistance curve leads to observations helpful in selecting fans. Fig. 3 shows fan characteristics selected to handle 70,000 cfm at 4.3-in. static pressure, point *a*. Now if system resistance changes for some reason to 6.3 in. while still requiring 70,000 cfm, the fan will not operate at point *a* but at *c*. This is located by drawing a new system-resistance curve through *b*. Appreciably less air is handled than under original conditions. Such capacity reductions are a minimum for fans with radial or backward-curved blades, which have steadily rising pressure characteristics with decreasing flow. Fans with forward-curved blades have a dip in their pressure curves immediately to left of peak efficiency, Fig. 4, and under similar conditions rating may be shifted to left in the unstable region with considerable capacity reduction and increased noise level

When system resistance decreases at a given flow, fan-rating point moves to right on curves with increased capacity and horsepower and decreased efficiency.

Pressure Changes. Another example of fan-law applications follows from permanent changes in the system. For instance if the fan, Fig. 2, has its system characteristic changed by installing a dust collector so static pressure is increased from 10 to 12 in. at the flow of 53,000 cfm, find new fan speed needed to maintain flow at the higher pressure. Fig. 5 represents fan performance as originally installed running at 1080 rpm; *b* is the new point of operation needed. New point of rating at 1080 rpm, *c*, is found from intersection of new system-resistance curve passing through *b* and the 1080-rpm fan static-pressure curve. Efficiency at this new point of rating is 75% versus original 73.5%.

To calculate the new speed, use law *a* from the table, then new fan speed at point $b = 1080(53{,}000/49{,}600) = 1156$ rpm. Required hp $= 0.000157 \times 53{,}000 \times 12/0.75 =$ 133.3 hp at 500 F.

New Fan Diameter. Often performance must be figured from a different-

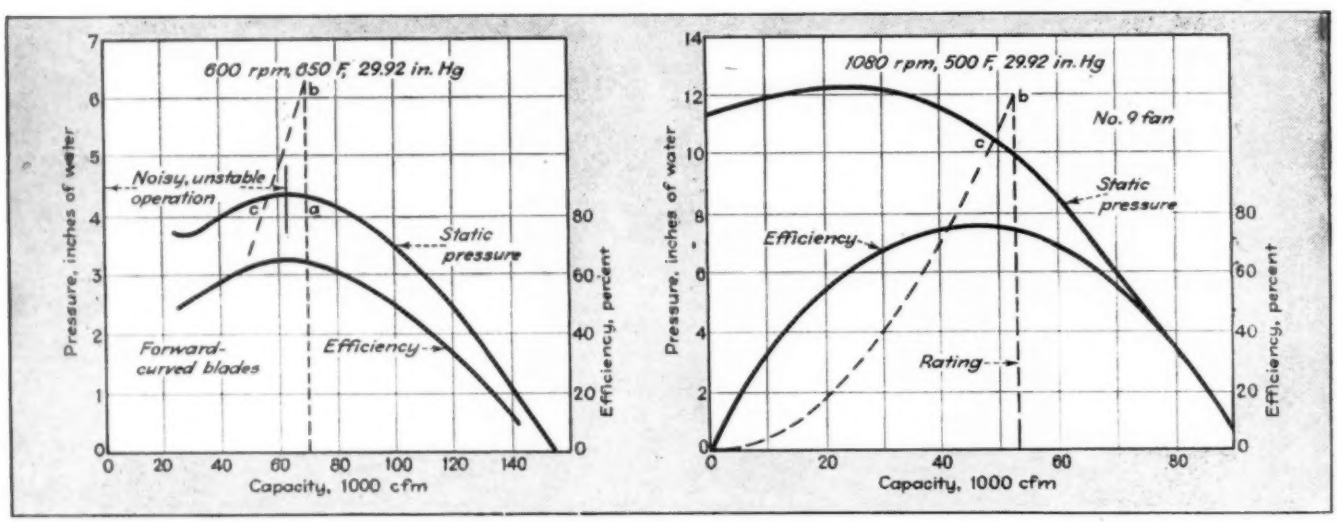


Fig. 4—Changes in system resistance may throw a fan with forward-curved blades into region of unstable operation

Fig. 5—The first step in calculating proper speed for a new fan rating is to establish system resistance curve

NOMENCLATURE

A_o = fan outlet area, sq ft
d = gas density, lb per cu. ft.
D = fan-wheel diam, ft
Hp = fan brake horsepower
K = constant
N = speed, rpm
P = pressure, in. of water
Q = capacity, cfm
V_o = gas velocity, fan outlet, ft. per min.
V_p = fan peripheral speed, ft. per min.

TABLE OF FAN LAWS

Law	Changed	Held constant	Capacity	Pressure	Horsepower
a	Speed	Size, density	$Q_2 = Q_1\left[\frac{N_2}{N_1}\right]$	$P_2 = P_1\left[\frac{N_2}{N_1}\right]^2$	$Hp_2 = Hp_1\left[\frac{N_2}{N_1}\right]^3$
b	Size	Speed, density	$Q_2 = Q_1\left[\frac{D_2}{D_1}\right]^3$	$P_2 = P_1\left[\frac{D_2}{D_1}\right]^2$	$Hp_2 = Hp_1\left[\frac{D_2}{D_1}\right]^5$
a & *b* combined	Speed, size	Density	$Q_2 = Q_1\frac{N_2}{N_1}\left[\frac{D_2}{D_1}\right]^3$	$P_2 = P_1\left[\frac{N_2}{N_1}\right]^2\left[\frac{D_2}{D_1}\right]^2$	$Hp_2 = Hp_1\left[\frac{N_2}{N_1}\right]^3\left[\frac{D_2}{D_1}\right]^5$
c	Density	Size, speed	$Q_2 = Q_1$	$P_2 = P_1\frac{d_2}{d_1}$	$Hp_2 = Hp_1\frac{d_2}{d_1}$
a, *b*, *c* combined	Speed, size, density	.....	$Q_2 = Q_1\frac{N_2}{N_1}\left[\frac{D_2}{D_1}\right]^3$	$P_2 = P_1\left[\frac{N_2}{N_1}\right]^2\left[\frac{D_2}{D_1}\right]^2\frac{d_2}{d_1}$	$Hp_2 = Hp_1\left[\frac{N_2}{N_1}\right]^3\left[\frac{D_2}{D_1}\right]^5\frac{d_2}{d_1}$

sized fan. Thus, calculate from the No. 9 fan curves, Fig. 6, speed and horsepower for a No. 10 fan rated to handle 70,000 cfm of 600-F gas against 12.5 static pressure.

No. 9 curves represent fan performance when handling 500-F gas, while the new rating specifies the fan develop 12.5-in. static pressure at 600 F. A fan develops less pressure when handling hotter (less dense) gas. To pick the rating from the 500-F curve the 12.5-in. static pressure must be increased to compensate for reduction in the fan's ability to create pressure at higher temperature. This corrected pressure is called equivalent pressure. Fan law *c* shows pressure is proportional to gas density. Furthermore, gas density varies inversely as absolute temperature. Then equivalent pressure = $12.5(460+600/460+500) = 13.8$ in.

Point *a* is then located at 70,000 cfm and 13.8-in. static pressure in Fig. 6. Next, correct the capacity for the difference between the new and the No. 9 fan base size. To do this find how the capacity varies with size when pressure remains constant. From combined laws *a* and *b*: $Q \propto D^3N$ and $P \propto D^2N^2$. From the latter it follows that $N \propto \sqrt{P} \times \frac{1}{D}$. Substituting this in the first equation, $Q \propto D^3\sqrt{P} \times \frac{1}{D}$ or $Q \propto D^2\sqrt{P}$. Then if pressure is kept constant $Q \propto D^2$ and equivalent air = (base fan size/actual fan size)^2 cfm = $(9/10)^2$ 70,000 = 56,700 cfm. Point *b*, Fig. 6, is the intersection of 56,700 cfm and 13.8-in. static pressure. Establish system-resistance curve through *b* and find intersection with the fan curve at 49,500 cfm, 10.5-in. static pressure and 75% efficiency. This is the point of rating on the base curve.

To calculate speed of the No. 10 fan simply retrace the steps. First correct base-curve speed for conditions at point *b* according to law *a*; then speed = $1080(56{,}700/49{,}500) = 1237$ rpm. Next step corrects speed for size change going from point *b* back to *a* at constant pressure. Remembering $N \propto 1/D$, find actual No. 10 fan speed = $1237(9/10) = 1115$ rpm. Horsepower required = 0.000157 (70,000×12.5/0.75=183hp (600F). To draw up the No. 10 fan curves apply combination laws *a*, *b* and *c* to various points on the base curve. Multiply:
base cfm by $(1115/1080)\ (10/9)^3 = 1.413$;
base static pressure by $(1115/1080)^2\ (10/9)^2\ (460+500/460+600) = 1.191$;
and base hp by $(1115/1080)^3\ (10/9)^5\ (460+500/460+600) = 1.685$.
When plotted, curve passes through 12.5-in. sp, and 183 hp at 70,000 cfm for 600-F gas and 1115-rpm fan speed.

Variable Speed. Where drives, such as turbines, wound-rotor motors, induction motors with hydraulic or magnetic couplings, are used it is often useful to present fan data in the form of variable-speed curves. Knowing one point of rating such as 53,000 cfm, 10-in. static pressure and 111.0 hp at 500 F, curves as in Fig. 7 can be drawn by applying law *a*. Vary: cfm as the rpm; static pressure as rpm^2; and hp as rpm^3.

The static-pressure curve has the same shape as a system-resistance curve and, like such a curve, all similar points of rating lie on it. For another operating condition with a different point of rating a new set of curves must be drawn up.

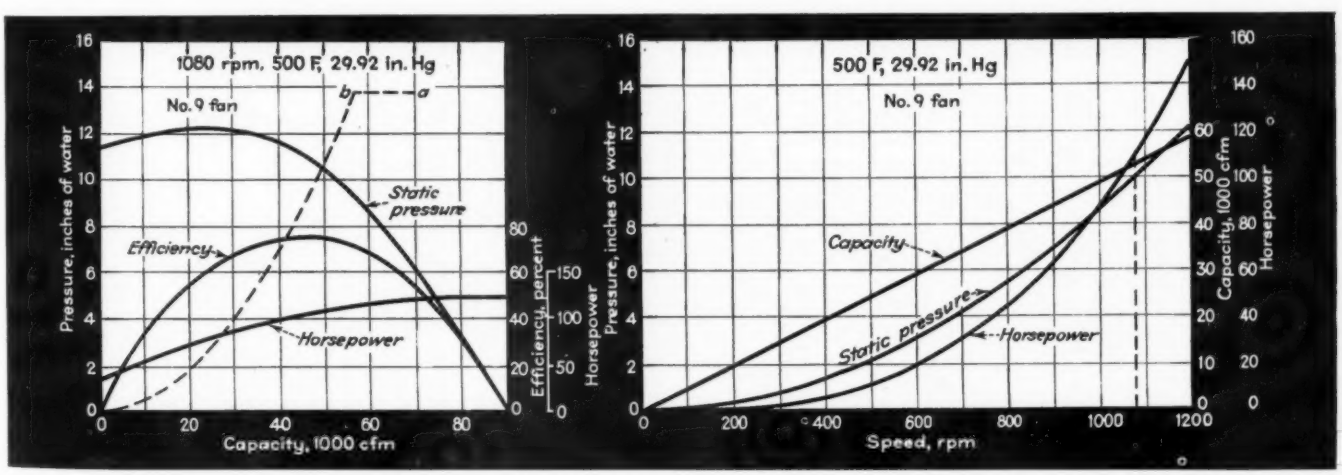


Fig. 6—In figuring performance of a fan from one of different size first find equivalent pressure at new rating

Fig. 7—Variable-speed fan-performance curves refer to similar points of rating, each of which has its own curve set

Expected Advantages Realized in Record of Automatic Air Soot Blowers

H L Smith, Buffalo Niagara Electric Corp, in describing the compressed-air soot-blowing system on three large boilers, cites gains achieved in economy and reduced makeup. Benefits from fully automatic operation prove distinctly important*

▶ THREE LARGE BOILERS on the Niagara Hudson System are now equipped with automatic air soot blowers: two at Oswego Station, in operation since 1940 and 1941; and one in Huntley Station No. 2, Buffalo, in operation since 1942. Each unit has a continuous rating of 900,000 lb per hr at 1320 psi and 900 F. The first two are "radiant" type with pendant superheater, and the third is "open-pass" type with drainable superheater.

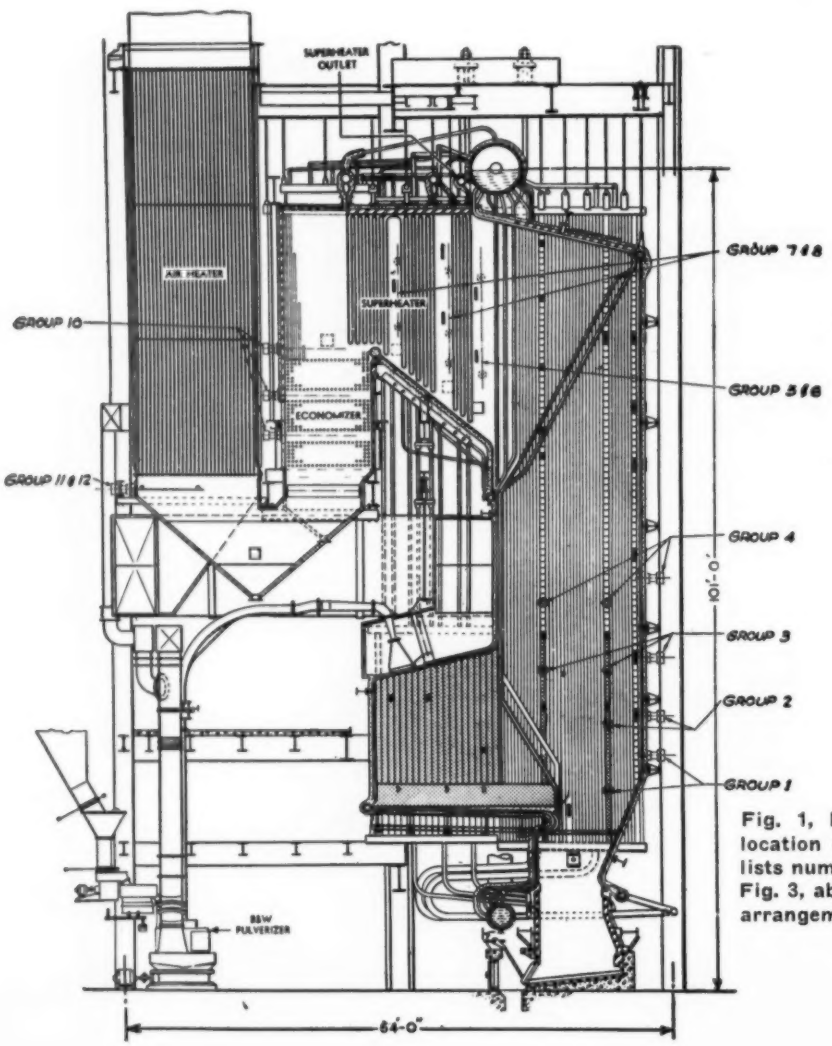
High operating pressure and temperature selected led to making every effort to reduce to a minimum loss of steam from the cycle. This not only meant a reduction in amount of boiler makeup and capacity of equipment to supply it, but also promised a general improvement in boiler water, thereby reducing superheater and turbine deposits.

Alternatives Compared. Since the conventional soot-blowing system would cause greatest steam loss, alternatives were studied, including use of an evaporator heat exchanger, separately fired low-pressure boilers, and compressed-air blowers. The first two schemes showed no advantage other than reduced makeup to offset increased investment over conventional steam blowers, whereas the third plan promised to: (1) reduce boiler makeup from 1.5% with steam to 0.5% (2) reduce energy consumption at the coal pile by 6.5 tons per day, and (3) reduce complete station investment by $25,000 per boiler.

Oswego Installation. Because the Oswego boilers employ all ordinary types of soot-blowing elements in use today, application of automatic air blowers to these units may be taken as typical, and so the Oswego system is described in detail. Diamond Power Specialty Corp furnished blower elements and automatic controls for all three boilers.

Fig. 1 and 2 show number and location of blowers on Oswego boilers and Table I shows types of elements. All are similar to elements in general use

* Based on paper presented at ASME semiannual meeting, Detroit, June 17-20, 1946



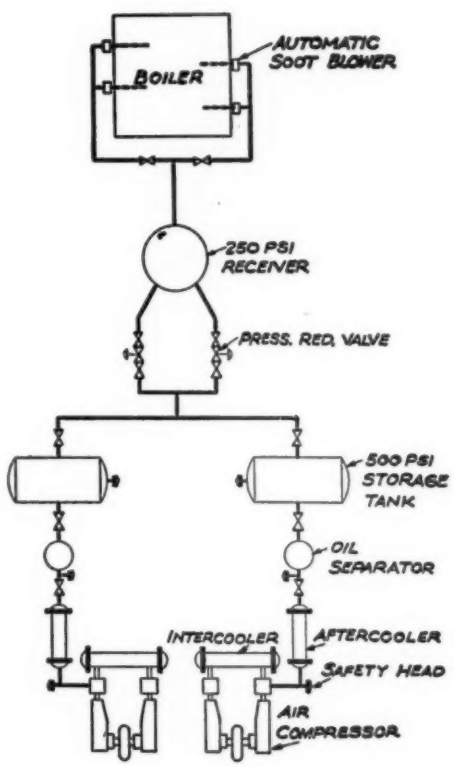


Fig. 1, left—Sectional view of Oswego boiler shows location of soot-blower elements. Table I, facing page, lists number and type of blower elements in each group. Fig. 3, above—Diagram of compressed-air system shows arrangement of compressors, auxiliaries, storage tanks

with steam, except for certain modifications of the air-puff units. Although construction of the element itself resembles the usual rotating steam element, it operates by giving a large puff while moving through a small arc; then it is jacked through another arc while giving another puff, and this procedure is repeated for the complete blowing range.

Soot-Blower Grouping. Group arrangement of soot-blower elements, a deviation from conventional steam practice, is required primarily to economize on air-compressing capacity, but also facilitates automatic control. Demand for air by some individual units exceeds 10,000 cfm for short periods and averages around 3000 cfm if all elements are blown successively with no appreciable time between. Most economical air supply results from taking advantage of maximum time that can be allowed for one complete boiler-cleaning cycle with continuous operation of the compressor during this period.

By selecting and arranging individual blower elements into proper groups, in which elements operate one at a time, it is possible to spread complete program over the maximum allowable time by enforcing a delay between groups. During these intervals, compressors pump into storage and build up pressure sufficiently to meet demand of each succeeding group at full pressure, 250 psi.

Compressed-Air Equipment. Fig. 3 shows, diagrammatically, compressed-air equipment for one boiler. Two 500-cfm 500-psi compressors discharge through aftercoolers and separators into 500-cu-ft storage tanks connecting through a common header and pressure-reducing valves to a 250-psi receiver.

Storage-tank pressure was intended to vary from 500 to 300 psi, to insure ample pressure for maintaining 250 psi in the receiver. Continuous operation of compressors for 6 hours was estimated as sufficient to operate all blowers through one complete cycle. This meant 18 hours' operation per day, assuming blowing once per shift. In actual operation, maximum pressure variation and time required to blow proved less than estimated. Size of storage tanks and compressors must be worked out for each installation to achieve economic balance and minimum cost.

Automatic Control. In general, 220-v 3-phase motors operate blowing elements except in the case of air-puff units, which are air operated. Electrical controls determine sequence of operation of elements within each group; as first motor-operated element completes its cycle a relay sends an impulse to the control of the next element, etc. The main program panel, Fig. 4, carries controls for each group. Switches can be set to start operation of any desired group and upon initiating the whole program the groups operate in sequence, beginning with the first switch in the upper left row. Normally groups are set in order of gas flow through the boiler. As each group starts, the corresponding number in the upper panel lights and remains lit until

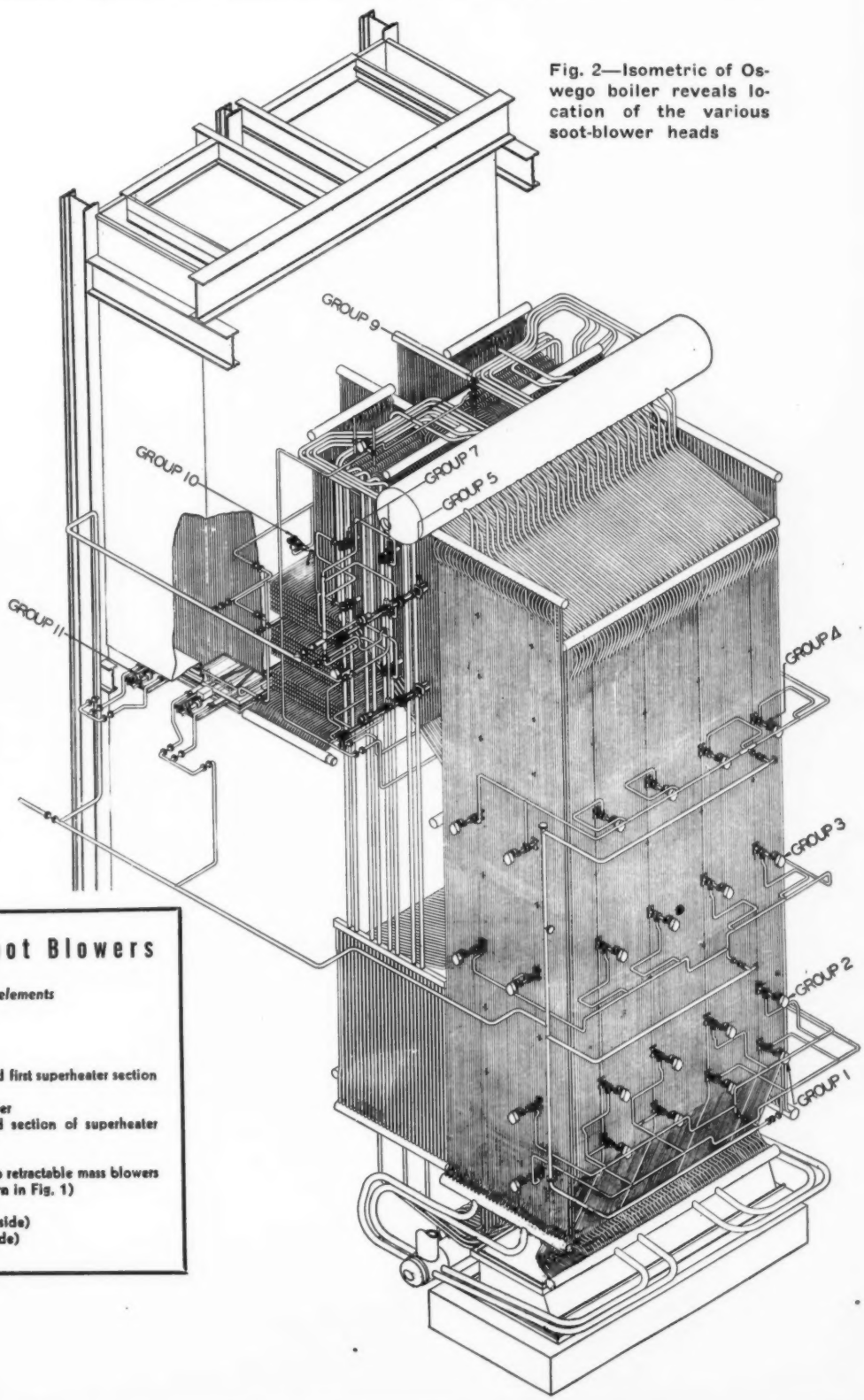


Fig. 2—Isometric of Oswego boiler reveals location of the various soot-blower heads

Table I—Arrangement of Soot Blowers

Group No.	Number and type of blower elements
1	Six retractable wall blowers
2	Six retractable wall blowers
3	Eight retractable wall blowers
4	Eight retractable wall blowers
5	Two 15-ft telescopic units for slag screen and first superheater section on near side of boiler
6	Two 15-ft telescopic units on far side of boiler
7	Five air-puff elements for second and third section of superheater on near side of boiler
8	Five air-puff elements on far side of boiler
9	Floor blowers for superheater section and two retractable mass blowers for superheater bypass section. (not shown in Fig. 1)
10	Nine air-puff elements for economizer
11	Two traveling-frame units for air heater (near side)
12	Two traveling-frame units for air heater (far side)

the whole program is complete and the light over each switch stays on during operation of the group set on that dial.

All groups have thrustor-operated valves controlling main air supply, which open at the start of each respective group cycle, provided main storage pressure is at predetermined value. These valves also close if pressure drops below 250 psi, except in case of the telescopic units. Thrustor valves for these units are equipped with latches holding the valves open until closed by a positive electrical impulse, insuring that air supply is never cut off while an element is extended into the furnace.

OPERATING RESULTS

Five years of operation have yielded much information regarding automatic air soot blowers.

Cleaning Effectiveness. Annual inspection has shown boilers unusually clean, although no hand-lancing or means other than soot blowing have been resorted to for cleaning. There have been no areas where better cleaning could be desired, with possible exception of tubes in the air heater in the immediate incoming cold-air region. There has been no evidence, while boilers were in operation, of unsatisfactory cleaning of walls or convection sections, and it has always been possible to control superheat.

Air Requirements. Operating experience has shown air requirements, fluctuation in storage-tank pressure and total operating time to be less than expected. With one boiler supplied from two compressors, storage-tank pressures of 385 psi maximum and 265 psi minimum and 5 hours total time per blow are required. Table II shows storage-tank pressures and operating times for one boiler supplied from four compressors, which is normal method of operation since installation of the second unit.

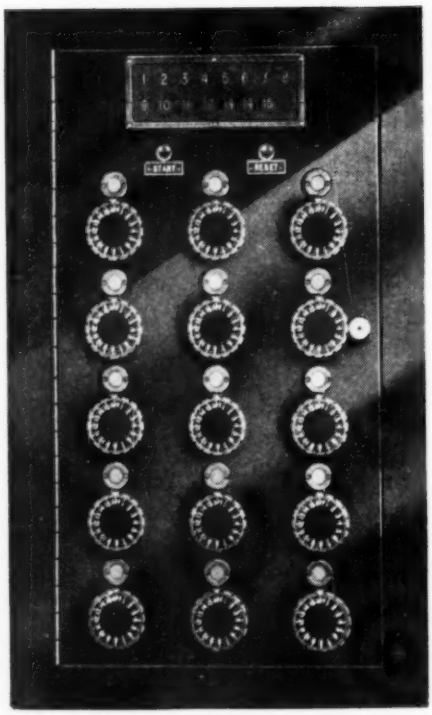


Fig. 4—Program panel for Oswego units has 15 control switches, 12 being used

Energy Consumption. Energy consumption for compressed air has proved to be only daily operating cost of any consequence, supplies and routine labor being negligible. Under normal operation, with a daily output of 15,000,000 lb of steam (65% load factor), each boiler requires 3400 kwhr to compress soot-blowing air. This demand increases a little at higher load factors and soot blowing is discontinued when boiler output is less than 180,000 lb per hr. The average value of 227 kwhr per million lb of steam may be compared with steam blowing, estimated at 1% of gross boiler output.

Maintenance Costs. Routine inspection and servicing have been principal expense chargeable to blowers, controls and piping. This has averaged about $1200 per year for materials and 3000 man-hours. For the air-compressing system, material cost has averaged $200 per year and man-hours 1500. These figures exclude cost of modifications.

Pressure Parts. Erosion of boiler-pressure parts caused by injury from air blowers has been slight. There has been no repair or replacement of any boiler parts for such cause.

Indirect Benefits. Other advantages resulting from use of automatic air blowers include: (1) reduced boiler makeup, which has averaged 0.3% instead of 1.5% as anticipated for steam blowing, and reduction of scale accumulation on turbine blades (2) ability to operate boilers continuously on automatic control while soot blowers are in operation, and (3) removal of human element in operation of blowers.

Actual operating data indicate that the difference in daily fuel consumption is 5.7 tons of coal in favor of compressed air. Although less than the 6.5 tons per day originally estimated, the difference in daily cost is greater because of the increase in coal prices. Table III shows relative investments for automatic-air and automatic-steam soot blowing, taking the installed cost of that part usually considered as steam-soot-blowing equipment as 100%. To these are added cost of compressor plant for air and required increase in makeup capacity for steam.

Table II—Oswego Boiler Units: Air Quantities, Pressures, Operating Time

Normal operation: one boiler, 4 compressors

Group	Storage tank pressures, psi Max	Min	Cubic feet free air	Time min	Estimated cubic feet free air
1	295	290	24,500	22	30,000
2	295	290	24,500	22	30,000
3	295	285	32,600	30	40,000
4	295	285	32,600	30	40,000
5	295	280	32,800	16	59,500
6	295	280	32,800	16	59,500
7	295	295	7,700	9	6,300
8	295	295	7,700	9	6,300
9	295	295	10,000	10	13,600
10	295	295	20,200	14	10,800
11	295	265	35,300	16	53,000
12	265	245	35,300	16	53,000
Total per blow			296,000	210	402,000
Total per day			746,000	570	1,150,000

Table III—Comparative Cost of Automatic Soot-Blowing Equipment

Equipment	Air system, percent*	Steam system, percent*
Blowers	25.0	27.0
Automatic valves and motor drives	10.5	20.5
Control panels and wiring	8.9	12.5
Piping to blowers	19.5	22.0
Erection of blowers	8.0	8.0
Indirect costs	8.1	10.0
Compressors	25.0	
Storage tanks	3.7	
Compressor plant piping	12.0	
Total direct blower equipment	120.7	100.0
Additional makeup equipment	....	7.3
Boiler plant for steam	....	54.3
Complete generating plant for air	20.0	
Station investment required for soot blowing	140.7	161.6

* Steam blower equipment costs equal 100%.

Portable 3-Fluid U-Tube Stand Speeds Flowmeter Testing

Setup consists of two large-diameter head equalizers and U-tubes for water, tetrabromoethane and mercury. Using air to produce differential head, this apparatus cuts man-hours in half and eliminates the high, difficult-to-adjust water column

By E P PRAHL
Test Bureau
Consolidated Edison Co of New York, Inc

▶ WHETHER THE FLUID that is being metered is steam or water, flowmeters must be checked and calibrated frequently to assure correct records for studying and improving equipment performance. Because most flowmeters operate on differential pressures produced by the fluid flowing through a restricted passage in the pipeline, a similar range of differential pressures must be applied to the meter manometer to check for accuracy at points along its scale.

Typical Test Procedure. Conventional way to apply these pressures is to connect water columns to the manometer taps and vary the water heights to produce the required pressure differential. This extremely cumbersome method requires at least two men, at times, especially with meters that operate on differential pressures above 100 in. of water. Here the high-pressure column must consist of a small vessel connected to the manometer through 20 or 25 ft of rubber hose so the vessel can be raised to the proper height. Facilities to do the raising are not always convenient. Sometimes the vessel must be hung on the wall at some distance from the meter, which requires longer hose, or it may be necessary to support the vessel on a rope suspended from overhead pipes or beams. Aside from the many mechanical inconveniences it is also difficult to assure complete removal of air from long sections of hose.

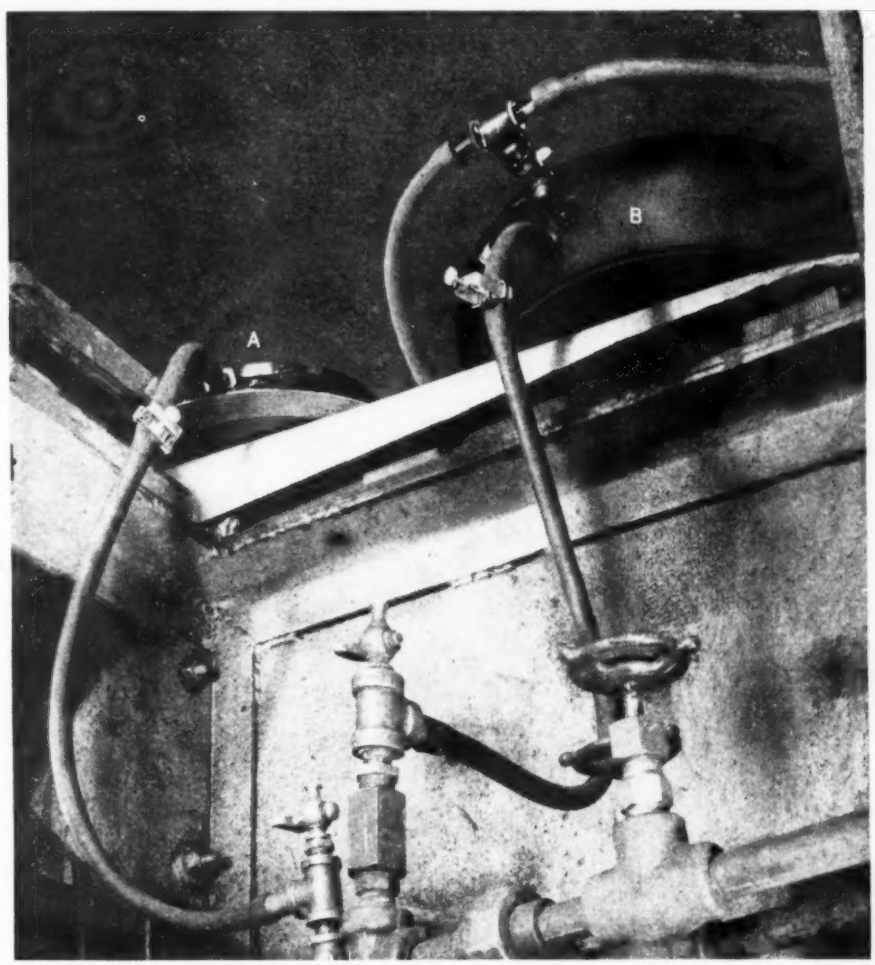


Fig. 1—The head equalizers, A and B, must be at the same elevation and slightly above the meter. Unit B is a pressuretight vessel into which the air is admitted

PARTS EASY TO FABRICATE

Other disadvantages of the conventional method are spillage that occurs during the test and inconvenience of filling the low-pressure leg. On the up-scale calibration (increasing the differential pressure) water in the manometer, displaced by the moving-meter elements, flows out the low-pressure tap onto the floor. And on the down-scale calibration, water must be poured into the low-pressure leg to maintain constant head.

The new test equipment, Fig. 2, eliminates the disadvantages of the conventional method and makes flowmeter testing a one-man job. Apparatus consists of two water-leg equalizers, and a 3-column U-tube with reservoirs and glass tubing. The equalizers, *A* and *B*, Fig. 1, are made from 10-in. pressure gage cases; the one for the high-pressure leg uses two cases brazed together to make a pressure-tight container and the low-pressure one uses an open case. A short hose connects from the existing opening in the side of each equalizer to the proper meter-manometer tap. When testing a meter both hose lines are filled with water from the open equalizer and through the meter bypass up to the half-way mark in both equalizer cases.

Only purpose of the equalizers is to

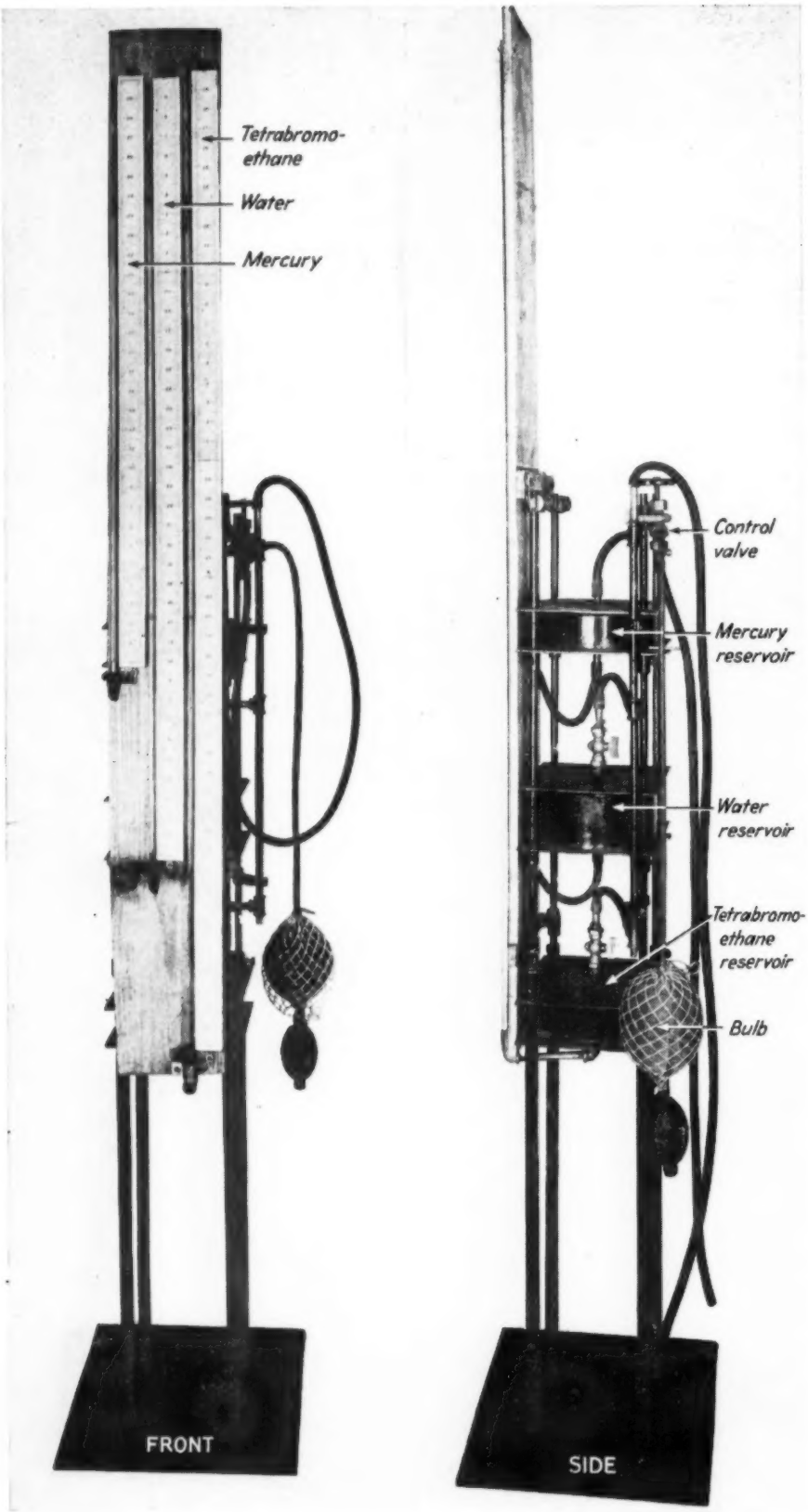


Fig. 2—Mercury, water and tetrabromoethane reservoirs, connecting lines and gage columns mount compactly on a stand fabricated from pipe. Necessary hose and aspirator remain attached to outlets. Because the test stand is short it can be placed close to the meter being tested. Thus one man can compare the meter indications with those of the U-tubes. The apparatus is easily made portable by attaching, on one side of the base, two rollers that contact the floor when the unit is tipped to a 45-deg angle. During test baseplate rests on the floor

maintain equal water legs on the meter. Making them large in diameter accomplishes this because water displaced in the meter element causes only slight change in liquid level. For example in a 212-in. water-head meter the volume of water displaced from zero to maximum differential is about 375 cc. This causes an over-all difference of level in the two equalizers of 0.5 in., or an error of 0.2%. More about this error later.

Applying the Pressure. With the equalizers mounted at the same level slightly above the meter, Fig. 1 and 3, and the passages properly filled with water, differential heads can be put on the meter by applying air pressure of different values above the water level in the high-pressure (closed vessel) equalizer. Air can be secured from a compressed-air source, or applied with a bulb aspirator. For measuring the applied pressure a test stand mounts U-tubes and reservoirs containing water, tetrabromoethane and mercury for low, medium and high differential pressures respectively. Air pressure applied to high-pressure equalizer chamber also goes to a pipe header connecting to the U-tube reservoirs so the correct U-tube can be cut into the circuit to indicate test pressure, Fig. 3.

Fabrication Is Simple. U-tube reservoirs are made from a 2-in. sheet-metal strip rolled into a 6¼-in. diameter cylinder and welded. Thin-metal plates, 7 in. square, welded in place form the heads. Iron is used for mercury but other metals can be used for water and tetrabromoethane. Center of each end plate is drilled and tapped for a ⅛-in. pipe fitting; bottom connection goes to the reservoir's respective ¼-in. glass tube and the top one to the common header leading to the high-pressure equalizer chamber. A tee in the header connects to the aspirator bulb and a needle-valve bleeder. Valves inserted in the water- and tetrabromoethane-reservoir branch lines permit closing these indicators off when using the mercury U-tube.

EASY TO TRANSPORT

Entire apparatus mounts on a stand consisting of four ⅛-in. pipes, 4 ft long, screwed into the corners of a 12-in. baseplate. Casters on one side of the base (not shown) contact the floor when the stand is tilted to a 45-deg angle and make it easy to push the stand from place to place. Holes drilled through the end-plate corners of each reservoir allow the latter to slide down the four uprights and rest on collars that can be adjusted for height and locked with a set screw.

In operation the two head-equalizer

chambers are placed on the panel top, Fig. 1, above the meter, and the connecting lines filled with water by pouring it into the open vessel. Opening the meter bypass valve permits both legs to fill at the same time; entering water purges the system of air. Connect the hose from U-tube stand to high-pressure equalizer, cut in the proper U-tube and pump in the air, meanwhile watching the U-tube liquid level until it reads the required pressure.

Effect of Level Change. Referring back to the 0.2% error caused by the liquid level change in the equalizers we also find an error between the U-tube level, as read at the gage column, and that actually existing between the gage column and reservoir liquid levels. This error amounts to 0.15% but fortunately it is in the opposite direction and partly cancels that in the equalizers, leaving a final error of only 0.05%—considerably less than can be expected from water-column check tests.

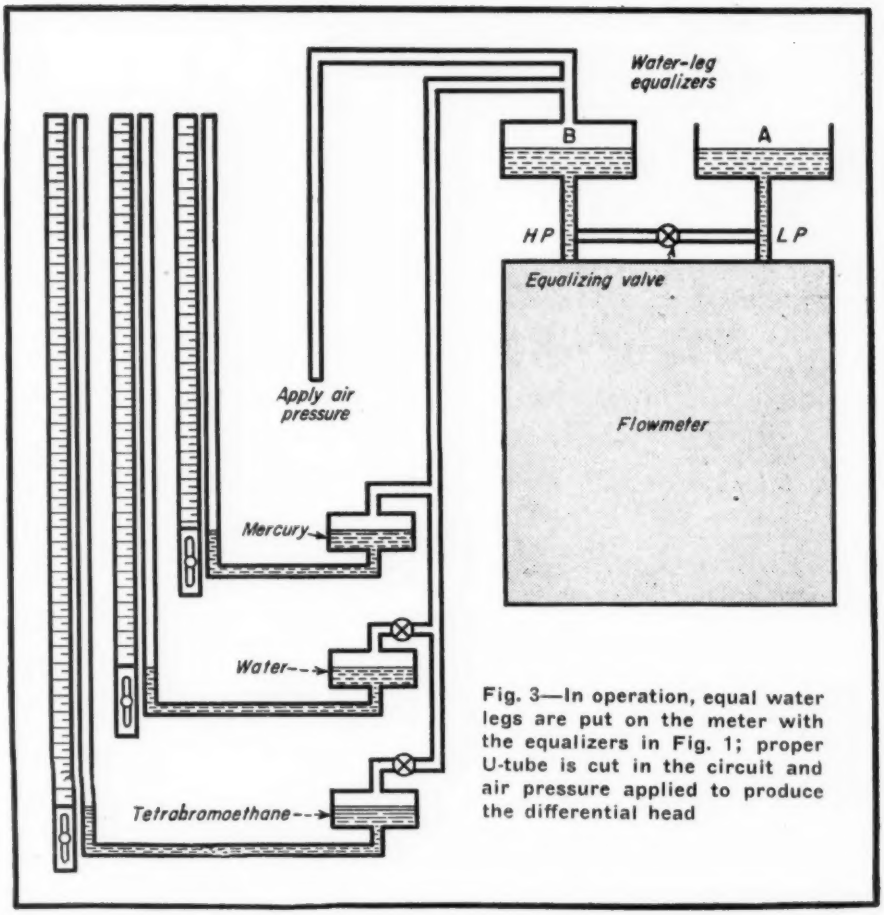


Fig. 3—In operation, equal water legs are put on the meter with the equalizers in Fig. 1; proper U-tube is cut in the circuit and air pressure applied to produce the differential head

FLUIDS HAVE WIDE RANGE

Fluids used in the U-tubes are (1) water, specific gravity 1.0, for meters of 0 to 40-in. water; (2) tetrabromoethane, specific gravity 2.97, for 40- to 150-in. meters and (3) mercury, specific gravity 13.6, for 150- to 400-in. meters. The water column checks low-range meters and lower scale of high-range units. Tetrabromoethane serves intermediate ranges doing away with tall water columns and spans the gap between water and mercury. High-range pressures are measured with the mercury column.

Chart for Tetrabromoethane. Because tetrabromoethane's specific gravity varies with temperature (at 60 F it is 2.976, and at 100 F it is 2.926) a set of curves should be plotted to determine its temperature before starting to use this U-tube. Measuring the ambient-air temperature with a thermometer is not accurate unless the test stand has remained at the location several hours.

HOW TO USE CHARTS

For instance, assume a meter has been checked over its low range up to 30 in. of pressure on the water column. Cut in the tetrabromoethane column and readjust the pressure so water column again reads 30 in. Suppose tetrabromoethane column reads 10.20. In *A*, Fig. 4, follow dotted line which indicates a temperature of 88 F. This is the true temperature and to put a differential pressure equal to 43.2 in. of water on the meter (curve *B*) the pressure as indicated by the tetrabromoethane U-tube must read 14.68 inches. The same temperature line must be followed on curves *C*, *D*, *E* and *F* for check points 58.8, 76.8, 97.2 and 120 in. of water respectively. Sample curves are for a meter having a 120-in. range in pressure differential.

Construction and operation of the apparatus are simple. Advantages are: (1) Tests require only one man. (2) Tests eliminate climbing hazards. (3) Several fluids can be used for testing over a wide range of meter differential pressures.

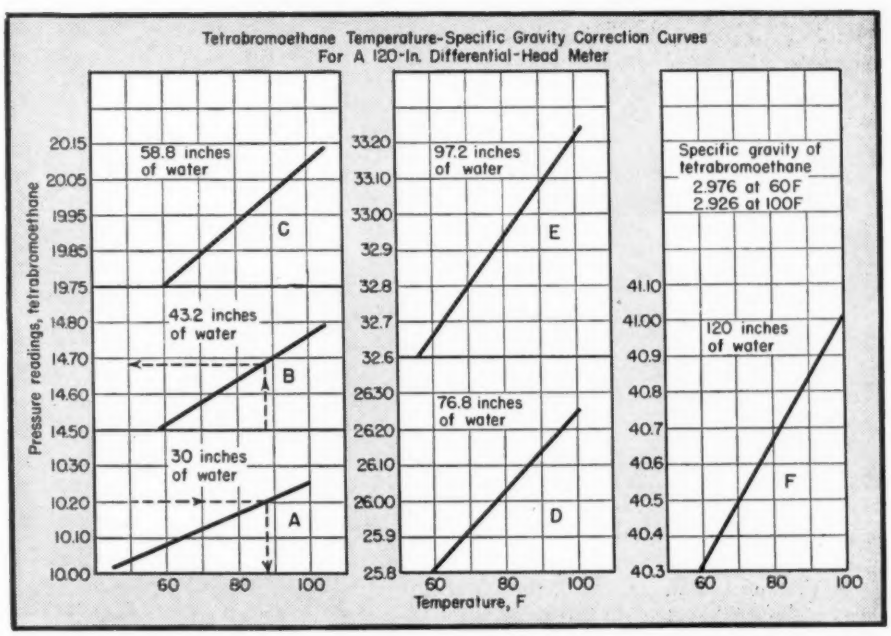


Fig. 4—Before using tetrabromoethane U-tube, check its reading against a 30-in. pressure on the water U-tube. Then consult curve A to determine its temperature

SHORT CUTS TO PLANT EFFICIENCY

By W A SHOUDY

No. 6—How Many Boilers?

In the final article of a series based on fundamentals, experience and common sense, a consulting engineer shows how to design an economical plant for process steam and power. No. 5 appeared in the July issue of POWER.

► BECAUSE A STEAM BOILER can have a capacity up to a million or more pounds of steam per hour it is possible to operate an industrial plant with one boiler or almost any number. Battery setting, that is two boilers with a common dividing wall, should be avoided. Hence, since aisle space is required, building costs increase with the increase in number of units. Above a capacity of 100,000 lb steam per hr there is no great increase in equipment cost. Two 100,000-lb units do not cost much more than one 200,000-lb unit, but two 50,000-lb units cost considerably more than one 100,000-lb, and as the size decreases the spread becomes greater.

The old rule was to select such a capacity that, with one unit out of service, maximum load would be carried by forcing the remaining boilers. This is an essential rule for continuity of service, as in public utilities without interconnections.

Industrial Power Plants. A plant falls into one of two major divisions according to whether it serves a process where interruption means (1) ruin of "stock in process" of manufacture or (2) loss of production during time of interruption only.

A momentary shutdown of the first class not only ruins stock but generally requires considerable time for cleaning machines before manufacturing can begin again. The financial loss is often so great that it warrants the increase in fixed charges due to spare equipment. Its additional cost is insurance.

A shutdown of the second class is less serious. Production loss during the time of power failure only may be made up by operating longer hours or over a weekend. It is sometimes hard to justify spare equipment on the chance that a small financial loss may be due to a rare power failure. Even the postwar trend is toward manufacturing in more than one shift. Moreover, shutdowns on Saturday and Sunday permit equipment maintenance that prevents shutdowns during manufacturing. Only an accident should cause loss of service with such operating hours.

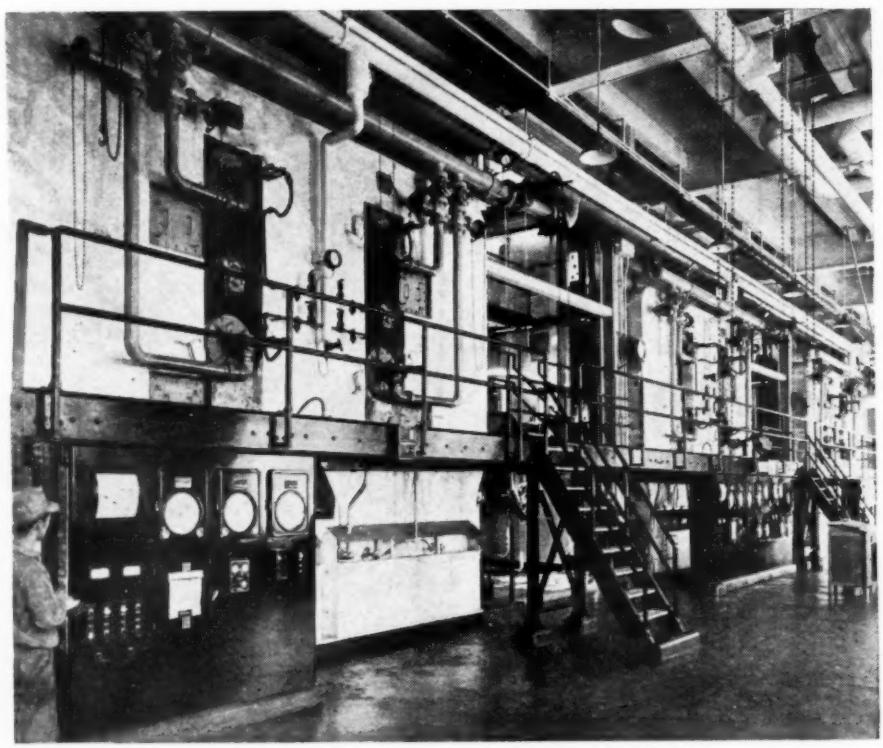
BOILER INTERRUPTIONS

Today there is little excuse for losing boiler tubes through scale. Feedwater treatment is available for the worst water, and with conscientious operation the annual turbining of tubes becomes only a formality, an added precaution. No boiler need be taken out of service for internal cleaning oftener than once a year, and weekend shutdowns provide sufficient time for external cleaning.

How Many Units? With a 5-day week and no stock to ruin by power failure a one-boiler plant has proved very satisfactory and is the cheapest in first cost.

If a factory runs as a unit two boilers are of little advantage unless either can carry the entire load; that is, one should be a spare. In a factory with more than one unit of manufacture the loss of one of two boilers halves production. The use then of two or more boilers insures production despite the loss of one boiler.

Continuous Boiler Capacity. Factors limiting continuous capacity are the amount of (1) fuel that can be burned in the furnace without choking the stoker with ash, or choking the gas passages with slag, or ruining the furnace walls and (2) steam that can be delivered by



Typical boiler-room firing aisle shows on-the-job application of carrying plant steam load with several duplicate units for flexibility and for reserve capacity

the drum without excessive moisture. Coal furnaces can operate at higher than continuous rating for four or five hours before ash and slag restrict output. Oil and gas have no ash problems.

Continuous boiler capacity is not an elastic term. Manufacturers allow a margin for safety, and with good luck exceed the guarantee. Formerly both turbines and boilers exceeded their rated capacity because designers did not know how to rate them. Today there is little margin except at additional cost.

We must not fool ourselves into buying a 75,000-lb-per-hr boiler that can be overloaded to 100,000 lb per hr for we will be paying for a 100,000-lb boiler with a 75,000-lb. nameplate. The purchaser may save a few dollars by selecting a smaller economizer or air heater to give the optimum efficiency at 75,000 lb per hr and sacrifice efficiency for the few hours operated at 100,000 lb, but he will still have a 100,000-lb steam-generating unit.

SPACE-CAPACITY COSTS

If the maximum plant load, including an allowance for probable factory growth, is 100,000 lb of steam per hr we may install one of the following:

1. One 100,000 lb-per-hr unit, with no spare. Installed capacity, 100,000 lb per hr; relative cost 100%.
2. Two 100,000-lb-per-hr units, one a spare. Installed capacity, 200,000 lb per hr; relative cost, 190%.
3. Three 50,000-lb-per-hr units, one a spare. Installed capacity, 150,000 lb per hr; relative cost, 175%.

Above combinations permit comparison.

COMPARATIVE COSTS OF BOILERHOUSES TO CARRY A LOAD OF 100,000 LB OF STEAM PER HOUR

	One boiler	*Two boilers*	*Three boilers*
Maximum capacity of each steam-generating unit...lb per hr	100,000	100,000	50,000
Total installed capacity.....lb per hr	100,000	200,000	150,000
Furnace width of each unit.....ft	14	14	7
Total width of each unit.....ft	17.5	17.5	10.5
Number of side aisles.....	2	3	4
Width of side aisles.....ft	8	8	8
Length of boilerhouse.....ft	33.5	59	63.5
Relative cost in percent			
Building and foundation.....	18.5	32.0	35.0
Boiler, economizer, furnace, draft system, etc.....	55.5	110.0	91.5
Coal and ash handling.....	9.5	11.0	12.0
Piping, valves and insulation.....	9.0	16.0	15.0
Feed pumps, heater and water system.....	5.5	5.5	5.5
Instruments and combustion control.....	2.0	3.0	3.5
Total.....	100.0	177.5	162.5

These relative costs, which vary with size and local conditions and unit sizes, should be used only as a guide. But usually one unit is the cheapest, three units the next highest, and two units the most expensive, though sometimes the actual dollar difference between three and two units is not great. Here engineering judgement proves most necessary.

One-boiler installation will be the cheapest in first cost and the unit should be designed for an exit-gas temperature of 400 deg at 100,000 lb per hr.

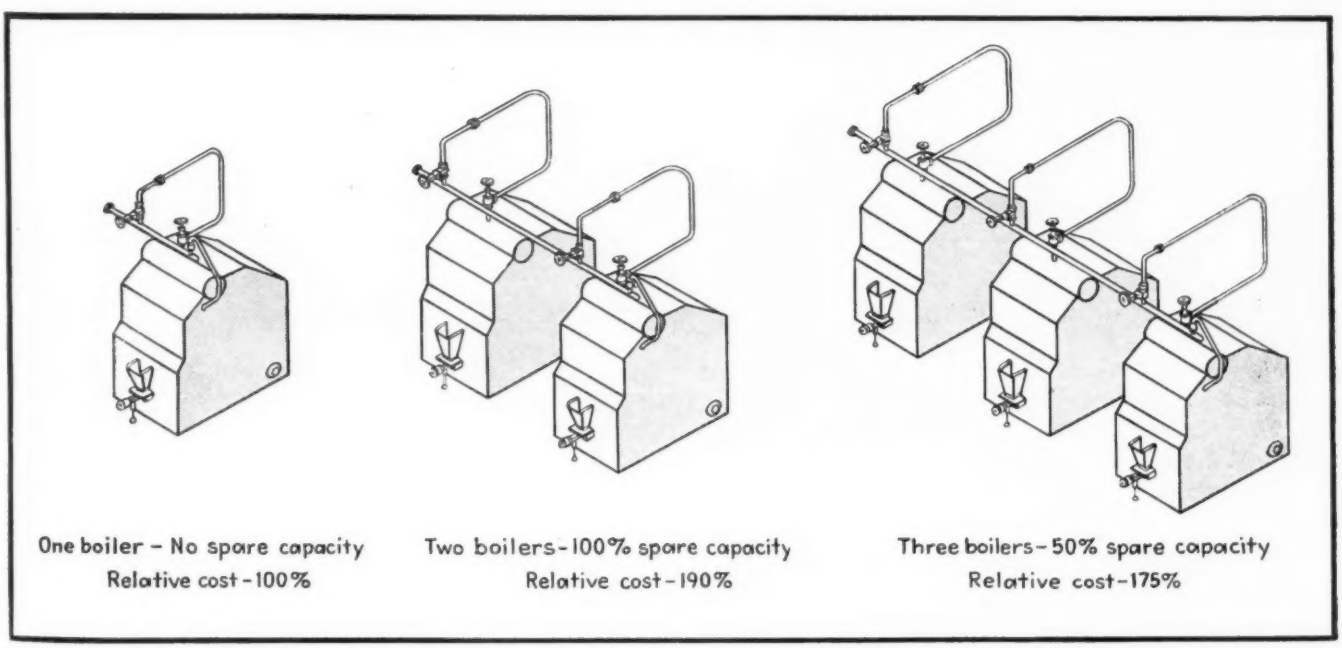
Two-boiler installations cost nearly twice as much as one-boiler, and each unit should have an exit-gas temperature of 400 deg at 50,000 lb per hr.

Three-boiler installations cost a little less than 2-boiler, and the exit-gas temperature should be 400 deg at 33,000 lb per hour per unit under operation.

Final choice depends upon how much the management can afford to pay in new fixed charges for service continuity.

Operating Cost of Spares. Until more than three boilers are installed the cost of operating labor is about the same, operation of three units being only slightly higher than one. Two units are somewhat simpler to operate than one because if the fires of one get out of control the load may be shifted to the other until the trouble is cleared up. In addition the flexibility in loading is an asset.

The necessity of using an existing building or ground-area restrictions may also be the deciding factor. Hence there are no rules, only broad principles. The decision must be based on engineering and business experience and judgment.



One boiler – No spare capacity
Relative cost – 100%

Two boilers – 100% spare capacity
Relative cost – 190%

Three boilers – 50% spare capacity
Relative cost – 175%

New Developments in Gas Turbines And Boiler-Plant Practice Reported

Engineers at Detroit ASME meeting hear of European progress in gas turbines, research in high-temperature metals, boiler designs for wide load variations, spreader-stoker experience, acid-cleaning of boilers and the problems of smoke prevention

▶ MORE THAN 1000 ENGINEERS from all parts of the country came to the semiannual meeting of ASME, held June 17-20 at the Hotel Statler, Detroit, to take part in a technical program particularly rich in interest to power-plant men.

In the opening session, S A Tucker, former associate editor of POWER, reported his first-hand observations of European gas-turbine development gained in a year overseas as engineering editor of McGraw-Hill World News. He pointed out that any appraisal of gas-turbine work abroad must be divided into two parts—military and commercial. In the former, Britain leads, having made substantial advances in straight jet engines employing centrifugal compressors. These rank among the best of their kind, but lack of suitable air-frame development has hampered application outside the field of military planes. For this reason it will be some time before British gas-turbine-powered commercial planes will be available. In all other applications of gas turbines, Britain lags behind the Swiss, who have made outstanding advances in railroad, marine and stationary gas-turbine development.

In the railroad field, Brown Boveri has built up a substantial background of experience with the 2500-hp locomotive built in 1939 for Swiss Federal Railways, and is now testing the power plant for a 4000-hp unit which is markedly superior. This new power plant, embodying refined design of standard components as well as new developments, uses the same weight of air as the former unit, and is only 3 ft longer, exclusive of the generators. Efficiency promises to be considerably higher than that of the first locomotive.

In the marine field, Sulzer Bros are well advanced in development of the semiclosed cycle described in May POWER, pp 72-74. The compact heat exchangers for the closed part of the cycle are fabricated, the combustion chamber and air heater, Fig. 2, has been tested and the next step will be assembly of the complete plant, which will produce from 7000 to 9000 hp.

At the Escher Wyss shops work is under way on a 12,500-kw closed-cycle plant for stationary service, Fig. 3. Following the general pattern of closed-cycle development outlined in Dr. Curt Keller's 1945 ASME paper (POWER, Jan 1946, pp 103-106) this plant operates on a 10 to 1 pressure ratio, from 700 to 70 psi, and at 1200-F throttle temperature has a guaranteed efficiency of 35% at the generator coupling, with all auxiliaries included and cooling water at about 55 F. At 1300 F, efficiency would be 37%.

This plant employs three stages of intercooling and one of reheating. The air heater, for oil- or gas-firing, is of 2-stage

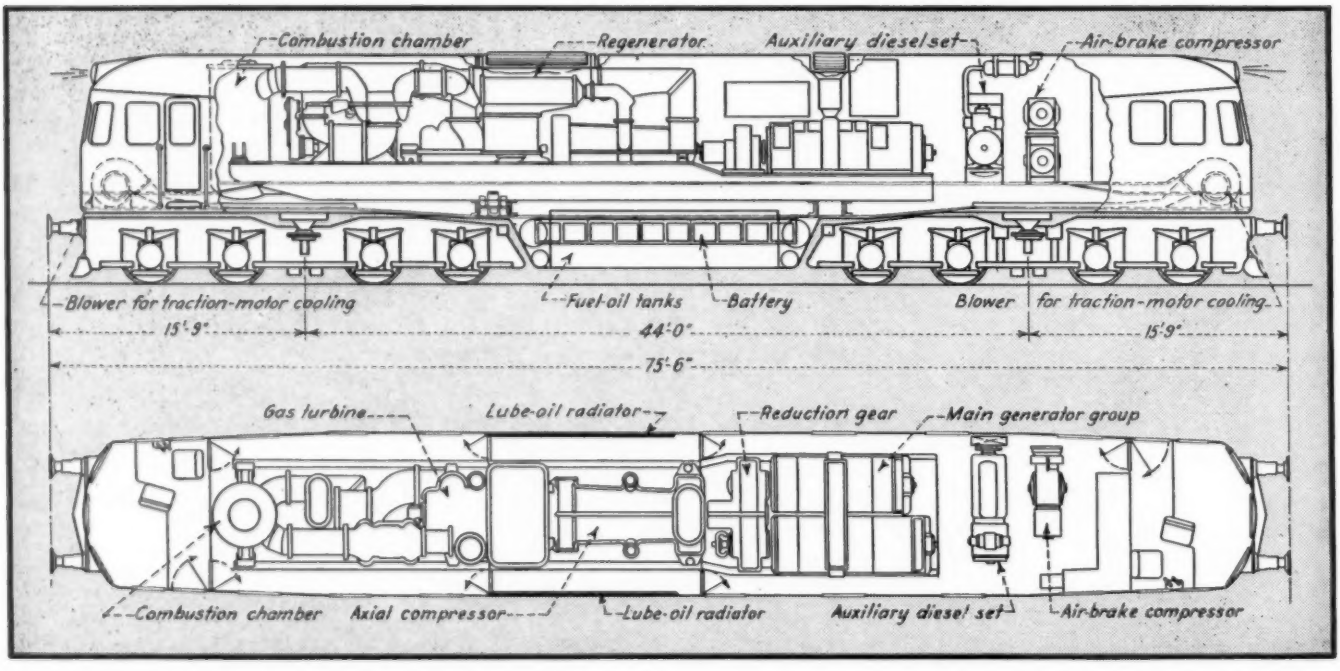


Fig. 1—Power plant for Swiss gas-turbine locomotive, now under test, uses same weight of air as existing 2500-hp unit and is only 3 ft longer, exclusive of generators, but is expected to produce about 4000 hp at a higher efficiency

design, taking care of both initial heating and reheating. It is supercharged to about 40 psi by a 3-stage radial blower driven by an exhaust-gas turbine. There are two air preheaters and flue gas is recirculated to control furnace temperature. The plant is controlled by adding or removing air from the working circuit, thus changing the density to meet load changes without variation in temperature.

Over-all dimensions are shown in Fig. 3. Working with air at high pressure, dimensions of rotating machinery are small: h-p turbine has a maximum diameter of 16 in., l-p turbine maximum diameter is 40 in., h-p compressor is 14 in. and l-p is 28 in. Plant layout features accessibility, with no heavy piping above machines to interfere with casing removal.

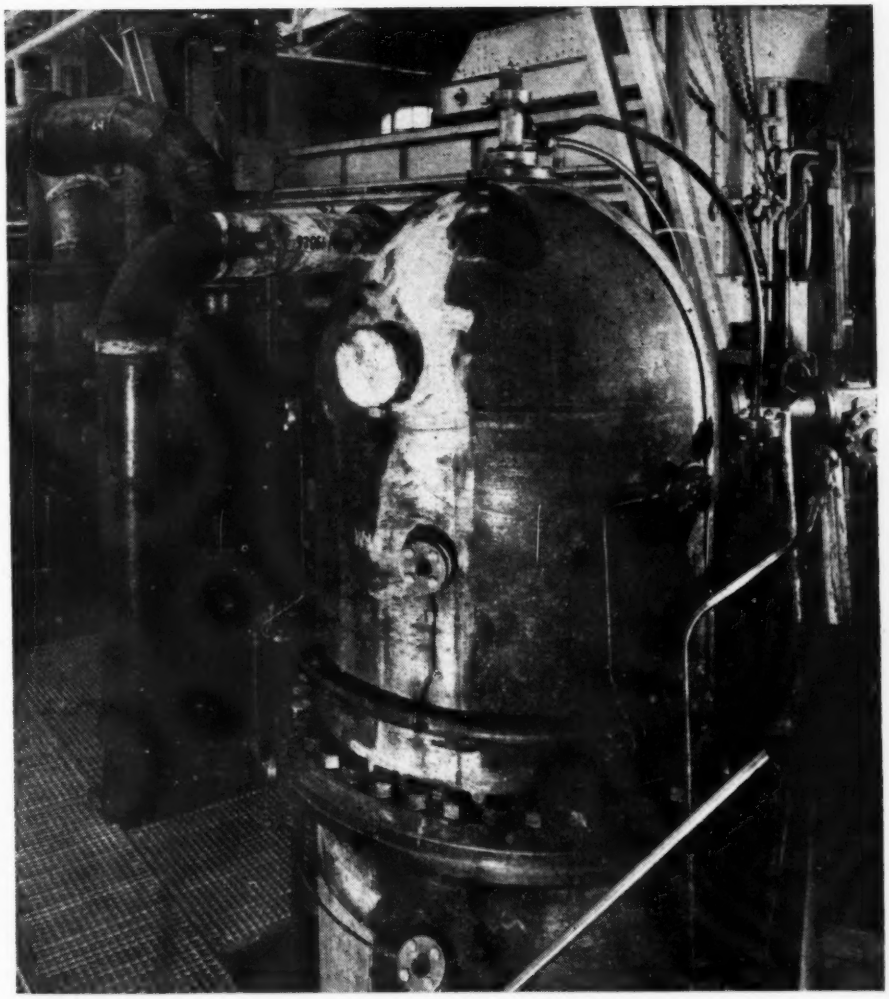


Fig. 2—Shop view of combustion chamber for 7000-hp marine gas-turbine operating on semiclosed cycle. Combustion products go to power turbine after passing over tubular heating surface in which flows air for compressor-turbine in closed cycle

GAS-TURBINE TEST DATA

At the same session, P R Sidler, president, Brown Boveri Corp (New York), outlined developments by Brown Boveri (Baden) in stationary open-cycle units. Of approximately 10 units now on order, six are in the shop and tests have been completed on the 10,000-kw unit for the Filaret plant, Bucharest, Rumania (POWER, Nov 1945, pp 64-69). This unit, designed for peak load and standby, is of 2-shaft design with reheating and intercooling but no regenerator. On test it showed a thermal efficiency of 23%, against a guarantee of 22%. Operation proved extremely smooth and a series of starting tests demonstrated ability to go from a cold standstill to speed in 4 min.

Strong interest was shown in papers dealing with the metallurgical research so necessary to gas-turbine development. A D Hughes, research and gas-turbine development division, Allis-Chalmers Mfg Corp, discussed the design and operation of experimental units to test the endurance life of turbine metals under actual service conditions. Largest and most important of these is the 1500-F 3500-hp unit installed at the Naval Experiment Station, Annapolis, Md. (POWER, May 1946, pp 68-71). This unit is being subjected to the most thorough testing yet given any full-scale unit.

LABORATORY TEST UNITS

For economical and convenient testing of high-temperature materials, a smaller test unit was constructed at Allis-Chalmers from a turbosupercharger fitted with two combustion chambers and the necessary duct work. This unit also lends itself to testing of combustion chambers and fuel nozzles. To give a more accurate indication of turbine-inlet temperature, a special thermocouple spider mounting 12 couples was devised. Citing examples of the results of research with small high-temperature gas-turbine units, Hughes described development of the double-bucket design, which greatly increased life of turbosupercharger blading. Tested to destruction, these double-bucket wheels ran over six times as long as the original single-bucket design.

Other special gas-turbine units built for research purposes at Allis-Chalmers include a unit for combustion-chamber work, and a test unit for determining the action of labyrinth sealing-gland strips under high temperatures. The speaker concluded with a series of ten principles of testing, which resulted from the experience gained in this type of research.

At the same session, N L Mochel, manager of metallurgical engineering, Westinghouse Electric Corp, presented a comprehensive discussion of the metallurgical considerations involved in gas-turbine work. Dealing primarily with the "hot" parts where the major problems exist, he pointed out that although requirements vary considerably among the many types of gas turbines, all solutions to metallurgical problems must consider stress, working temperature, expected service life and allowable deformation.

Alloys for high-temperature service may be grouped in four classes, Mochel said: (1) age-hardenable wrought alloys (2) work-hardenable wrought alloys (3) age-hardenable cast alloys and (4) cast alloys normally used as cast, not heat treated. Improved physical properties result from solution-treating and aging the first and third groups and by work-hardening those of the second group, but these effects can be lost with time and this must be considered in long-life applications. Likewise many of the alloys lose ductility with time at service temperatures.

Speaking of specific gas-turbine parts,

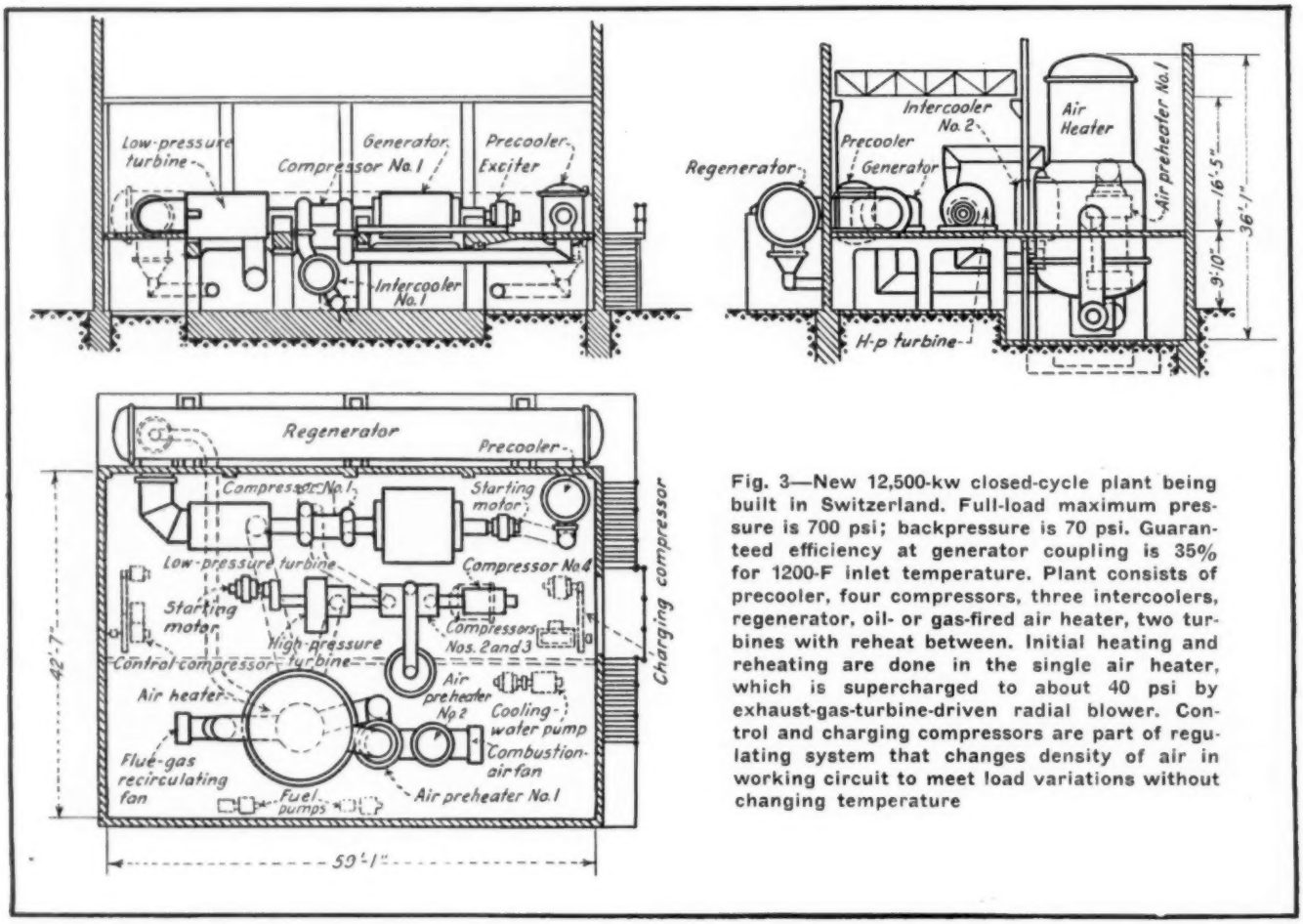


Fig. 3—New 12,500-kw closed-cycle plant being built in Switzerland. Full-load maximum pressure is 700 psi; backpressure is 70 psi. Guaranteed efficiency at generator coupling is 35% for 1200-F inlet temperature. Plant consists of precooler, four compressors, three intercoolers, regenerator, oil- or gas-fired air heater, two turbines with reheat between. Initial heating and reheating are done in the single air heater, which is supercharged to about 40 psi by exhaust-gas-turbine-driven radial blower. Control and charging compressors are part of regulating system that changes density of air in working circuit to meet load variations without changing temperature

Mochel pointed out that reasonable service life for combustion-chamber liners will probably be accomplished by ingenious design rather than by seeking more resistant materials. In this country, Inconel and 25-chromium 20-nickel 2-silicon stainless-steel sheet has been most widely used for this purpose in jet engines and some other turbines. Turbine casings present perhaps the simplest of the problems, with 18-8 stainless for outer casing and 25-20 for inner hot portions forming a good combination for aircraft gas turbines. For intermediate sizes of gas turbines, forged or cast alloys are available for turbine cylinders and the double-casing design used by Escher Wyss (POWER, Nov 1946, p 66) appears satisfactory and economical.

Turbine rotors and disks present a serious problem; both age-hardenable and work-hardenable alloys have been considered and used. However, it appears that when load-carrying ability is improved by heat treatment or working, ductility is lost at high temperatures. Research in hot-spin test pits is needed to decide whether it is best to accept lower load-carrying ability and reasonable ductility or to secure the utmost in load-carrying ability and accept poor ductility. While it is relatively easy to produce suitable disks for small units, large forgings of heat-resisting alloys form a difficult problem. This has led to use of various forms of built-up rotors comprising disks welded together according to a variety of designs.

GAS-TURBINE BLADE MATERIALS

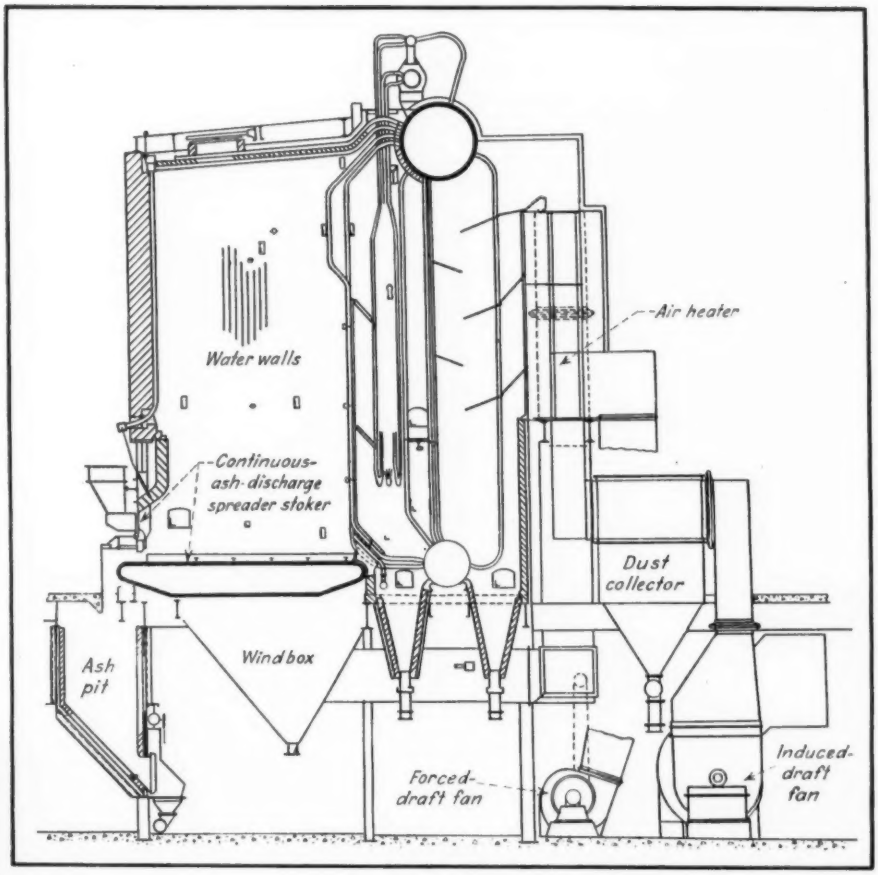
Probably more thought and effort has gone into blading and blade materials than any other gas-turbine element, Mochel said. Blades have been made by forging, machining from rolled bar stock and shapes, and by precision casting (POWER, July pp 95-98). Machining offers simplified metallurgical control and savings in cost, but may mean compromising on shape. Forging permits achieving any desired shape but involves difficulties at gas-turbine temperatures because the ability to flow and deform readily in a die is desired at forging temperatures not much higher than those encountered in actual gas-turbine service, when the metal must resist deformation.

The speaker expressed belief that principal hope for blades to operate at temperatures above 1500 F lies in precision casting. Hollow blades also merit attention because they require lesser quantities of limited elements, can result in lower stresses and provide for cooling by air or other means. Such blades have been produced by cupping and drawing from sheet metal, by forming and welding sheet metal, by forging from special shapes and by casting.

In conclusion, Mochel said we have come a long way in a few short years and must carefully evaluate what we have learned. We must know more about how materials behave in service, about high-temperature properties of sheet metals and welded joints, and about actual temperatures in disks and blades. We must try soon to see whether we cannot utilize lower alloy materials that are more readily obtainable, less costly and more easily produced.

In sessions dealing with boiler practice, considerable interest was shown in a paper by M H Kuhner, chief mechani-

Fig. 5—Experience with this boiler unit at Iowa Falls plant shows suitability of the continuous-ash-discharge spreader stoker for low-grade midwestern coals



cal engineer, Riley Stoker Corp, on "Boiler Design for Wide Load Variations." Using as examples boilers designed for the Harbor Steam Plant of the city of Los Angeles and for the power plant of the Homestead Works, Carnegie-Illinois Steel Co, the speaker stressed points requiring special attention in such units. A first consideration is to make available at once the heat stored in the boiler, since firing rate cannot be increased instantaneously when load swings are large. This means that the boiler is required to perform somewhat like a steam accumulator, with water in the drums flashing into steam at reduced pressure.

Sudden changes in steam-output rate, resulting in momentary disturbance of steam and water flow, require circulatory-system design that insures against stoppage or reversal of flow in any steaming tubes. Abrupt changes in internal sectional area within the circulatory system must be avoided. Releasing steam generated in the open space of the main drum above water level, Fig. 4, prevents geysering and turbulence and seesawing of water level. The drum in which steam is released and in which working water level is to be maintained must be unusually large. Since efficiency of steam cleaning and drying devices usually depends on height of water level in the drum and because large change in water-level elevation cannot be prevented during sudden large load changes, a larger-than-normal drum or a separate steam-purifier drum is indicated, Fig. 4.

Fig. 4—Steam-purifying system of unit designed to meet wide load variations

In a quick-load-pickup boiler, Kuhner pointed out, steam-temperature control is more difficult than in conventional units, requiring superheaters with both radiation and convection surface and a quick-acting means of control employing heat exchangers or direct water sprays. Rapid thermal changes in all parts of the boiler system require that special attention be given to mechanical and structural details. Disturbance of furnace conditions may result from rapid changes in combustion rates, and design of setting inclosure and gas and air passages, must provide for absorbing shocks resulting from puffs or light furnace explosions.

Extremely flexible fuel-burning equipment must be employed to meet wide changes in heat-input rates with no time available for lighting additional burners. The amount of excess fuel-burning capacity required is determined by the time permitted for restoration of full boiler pressure after load has been picked up by accumulator action. Selection of type, capacity and driving method of fans is governed to a large extent by the required rapidity and magnitude of steam-load changes. Automatic control is an absolute must, and time-lag of control equipment should be as short as mechanical limitations permit. It seems desirable to control feedwater flow entirely from working water level so entrance of fresh water is almost entirely interrupted during a sudden load rise and, conversely, large quantities enter the boiler immediately after a sudden load drop. This stabilizes water level and reduces required distance between highest and lowest working levels.

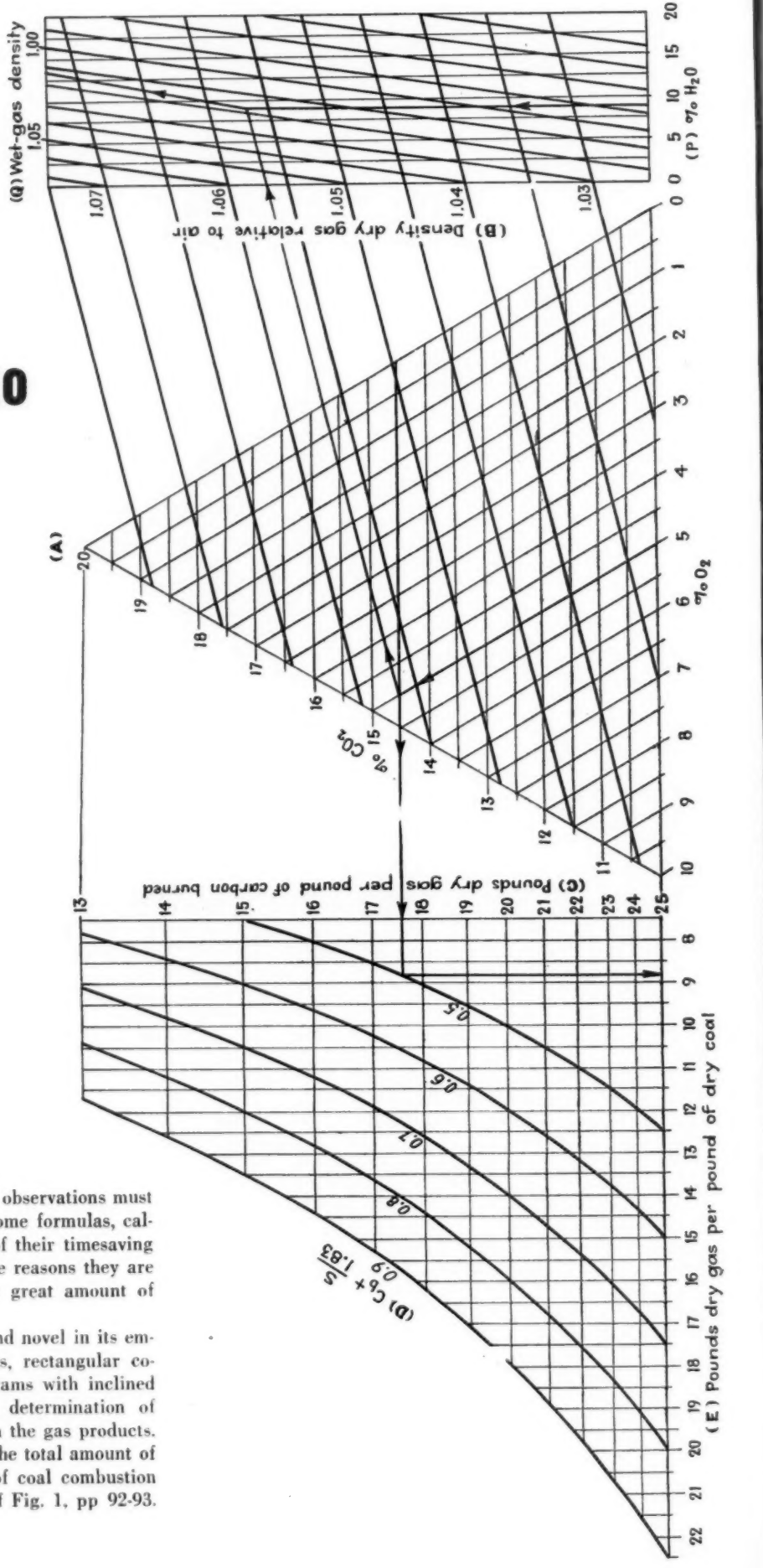
In another paper dealing with boiler practice, J M Drabelle, Central States

(*Continued on page* 154)

CHARTS

Shorten Time to Calculate Flue-Gas Moisture And Volume

The burden of making numerous repetitive computations concerning coal-burning apparatus design and testing is eased by this pair of calculating charts and nomograms developed by H Richardson, Research Corp



► In testing work where a large number of observations must be processed through involved and cumbersome formulas, calculating charts are of great value because of their timesaving and error-minimizing features. For the same reasons they are highly rated in the design field where any great amount of cut-and-try work is involved.

The chart designed for Fig. 1 is unique and novel in its employment of most known types of elements, rectangular coordinates, trilinear coordinates and nomograms with inclined scales. This graph makes possible rapid determination of flue-gas volumes and is based on zero CO in the gas products.

Fig. 2, p 94, is a nomogram to calculate the total amount of moisture present in the flue-gas products of coal combustion and is a necessary auxiliary to rapid use of Fig. 1, pp 92-93.

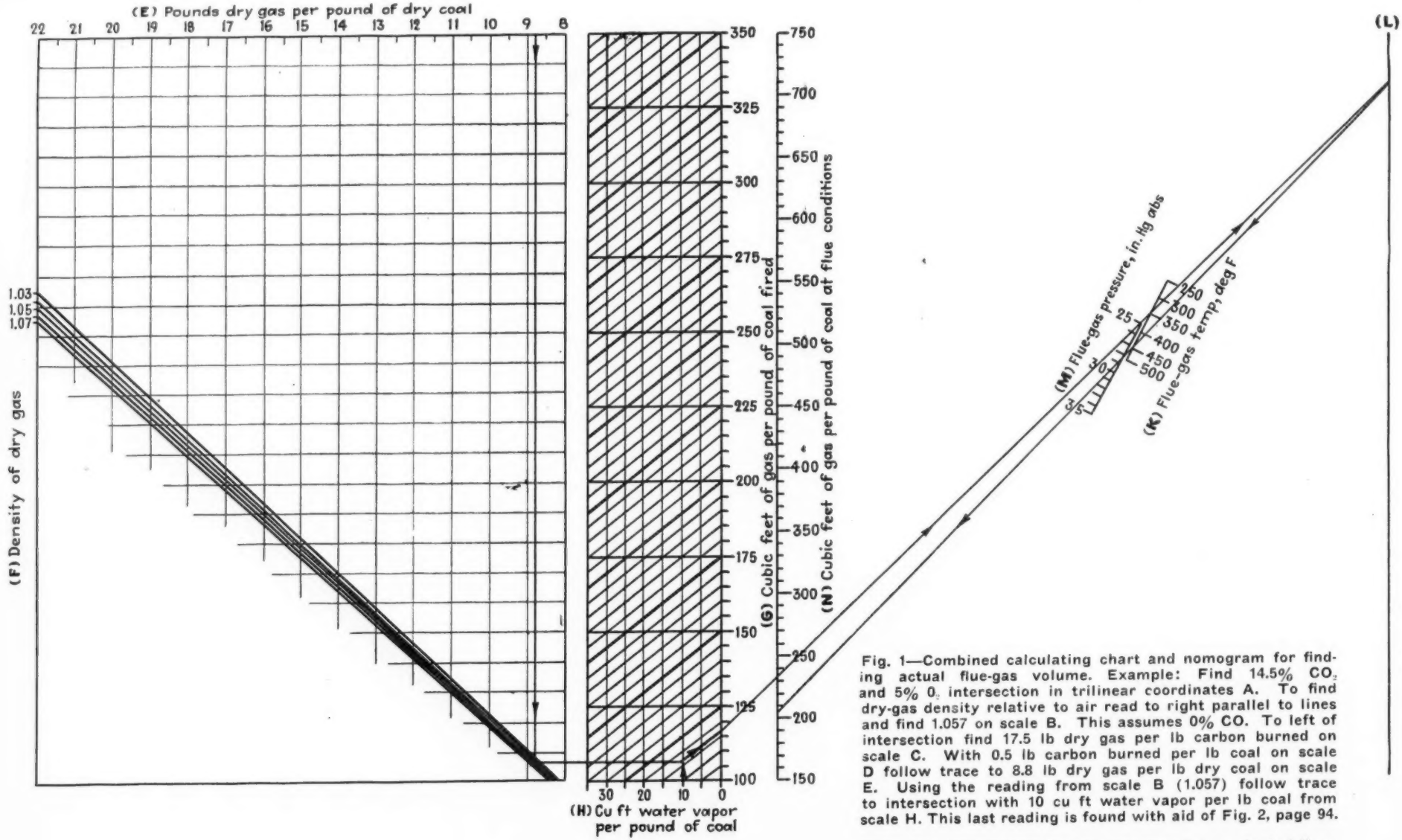

(E) Pounds dry gas per pound of dry coal
22 21 20 19 18 17 16 15 14 13 12 11 10 9 8
1.03
1.05
1.07
(F) Density of dry gas
350 325 300 275 250 225 200 175 150 125 100
(G) Cubic feet of gas per pound of coal fired
750 700 650 600 550 500 450 400 350 300 250 200 150
(N) Cubic feet of gas per pound of coal at flue conditions
30 20 10 0
(H) Cu ft water vapor per pound of coal
(L)
(M) Flue-gas pressure, in. Hg abs
25
(K) Flue-gas temp, deg F
250 300 350 400 450 500

Fig. 1—Combined calculating chart and nomogram for finding actual flue-gas volume. Example: Find 14.5% CO_2 and 5% O_2 intersection in trilinear coordinates A. To find dry-gas density relative to air read to right parallel to lines and find 1.057 on scale B. This assumes 0% CO. To left of intersection find 17.5 lb dry gas per lb carbon burned on scale C. With 0.5 lb carbon burned per lb coal on scale D follow trace to 8.8 lb dry gas per lb dry coal on scale E. Using the reading from scale B (1.057) follow trace to intersection with 10 cu ft water vapor per lb coal from scale H. This last reading is found with aid of Fig. 2, page 94.

From this intersection follow trace parallel to slanted lines to read 116 cu ft gas per lb of coal on scale G. Lay straight edge from G across 350-F flue-gas temperature on scale K to find intersection on line L. From this point lay straight edge to intersect 28 in. Hg abs flue-gas pressure on scale M and find answer of 205 cu ft gas per lb of coal at flue conditions on final scale N. Wet-gas density in flue may be found by following trace from scale P, the value on this scale being calculated from readings on scales H and G, to intersect with the trace from scale B; then follow slanted lines to scale Q

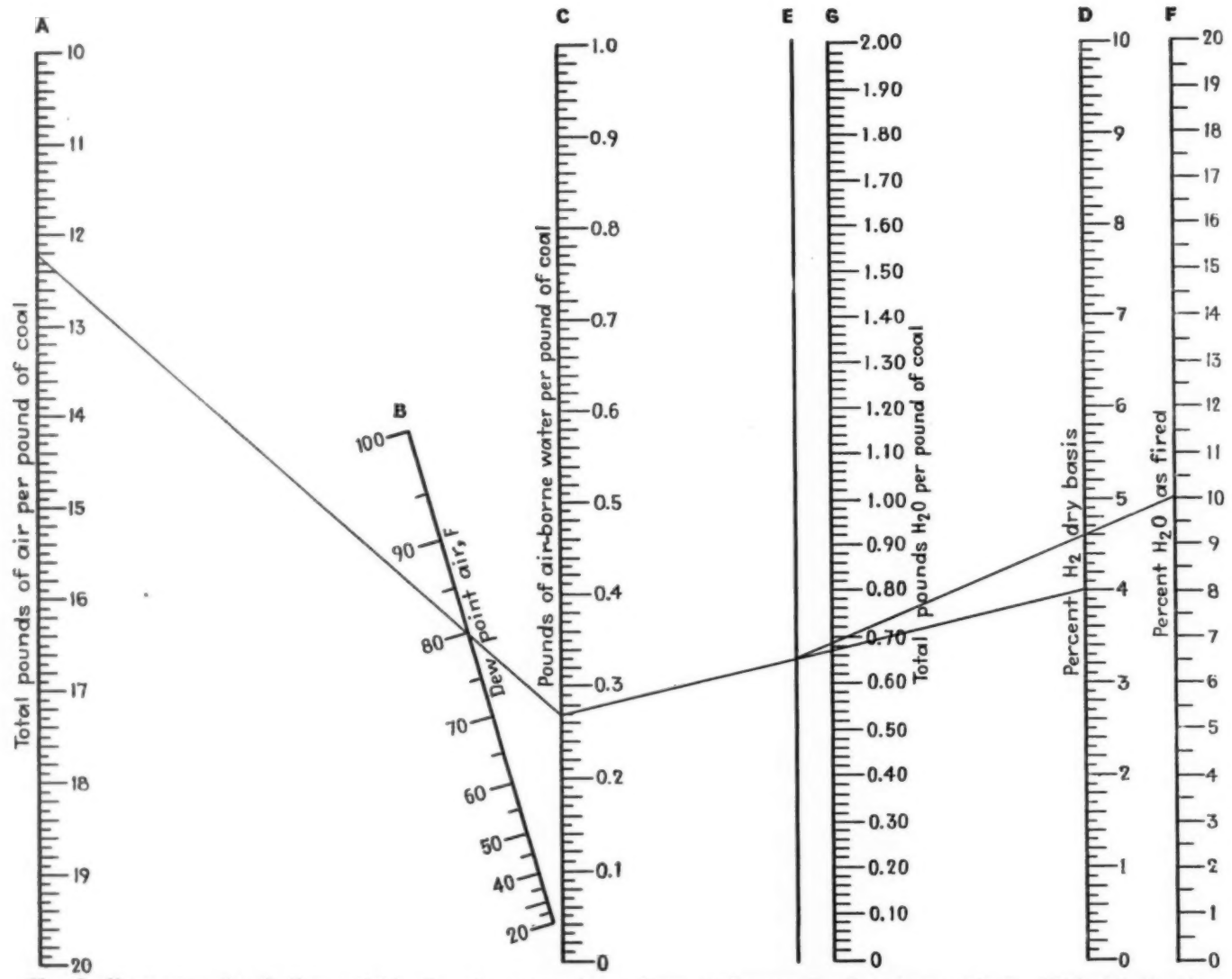


Fig. 2—Nomogram for finding weight of water vapor in flue gas per lb of coal burned. Example: For 12.2 lb of air per lb of coal burned and 80-F air dewpoint find points on scale A and B and lay straight edge to find 0.268 lb air-borne water per lb of coal on scale C. With 4% H_2 (dry basis) on scale D find intersection on line E, then with 10% coal moisture as fired on scale F find answer by intersection on scale G, 0.69 lb moisture per lb of coal fired

Care of Cast-Iron Hot-Water Boilers

► CAST-IRON HOT-WATER heating boilers should be of adequate size to supply heat without forcing. Following are helpful suggestions in caring for them.

1. Expansion tanks on open systems. Such systems are vented to atmosphere through the head of water between the boilers and the top of the expansion tanks, located above the highest radiator in the system. Most cast-iron heating boilers are constructed for a maximum water pressure of 30 psi, corresponding to a column of water 69 ft high. Thus, if a building height requires a greater head, use steam heating. Vent the expansion tank to atmosphere without shutoff valves in expansion line or vent pipe. Protect expansion system against freezing.

2. Expansion and pressure relief on closed systems. A vent on a closed system expansion tank usually has a valve that is normally closed. Water supply enters the system through an open valve. If supply pressure exceeds 30 psi, a pressure-reducing valve, a relief valve and a pressure gage are necessary. Set relief valve at not over 30 psi and limit boiler pressure to slightly less by the reducing valve.

3. Sediment removal is important. Open blowdown (drain) valve for a few moments once a week during the heating season. Each summer drain the system and flush out boiler with a hose through available pipe connections. When refilling system, vent air from each radiator.

4. Additional care and attention. Once a month on open systems, check expansion-tank water level and add water if necessary. Test relief valve on closed systems once a month, and observe pressure gage more frequently on closed systems. If gage indicates over 30 psi, reducing valve, relief valve or gage is in need of repairs. At the end of the heating season follow a general cleaning program.

POWER PERSONALITIES

Men as well as machines make power. Here are on-the-job views of some of these men—their training and experience, their responsibilities, their philosophy of work — the things that make for success in the power field

WARREN D. LEWIS, building superintendent and chief engineer of the 2500-room Hotel New Yorker, thrives on hard work and it's a good thing he does. In these days of 110% occupancy and of shortages of everything from tenpenny nails to turbine-generators, running the entire mechanical and electrical side of a large hotel is not without headaches. Add to this the fact that Warren is completing a successful term as president of the National Association of Power Engineers and you can see where the hard work comes in.

Taking over as chief at the New Yorker six months before the hotel opened, Warren Lewis and hotel engineering have been almost synonymous for the past 17 years. His practical views on the equipment and arrangement needed for successful supply of steam, electrical energy, building heating, refrigeration and air conditioning strongly influenced final design of the plant, which now consists of four pulverized-fuel and oil-fired boilers supplying 2200-kw of steam-engine generators, two diesel-engine generators (850 kw) for standby and summer heat balance, and related auxiliary equipment.

COMPLEX OPERATING AND MAINTENANCE JOB

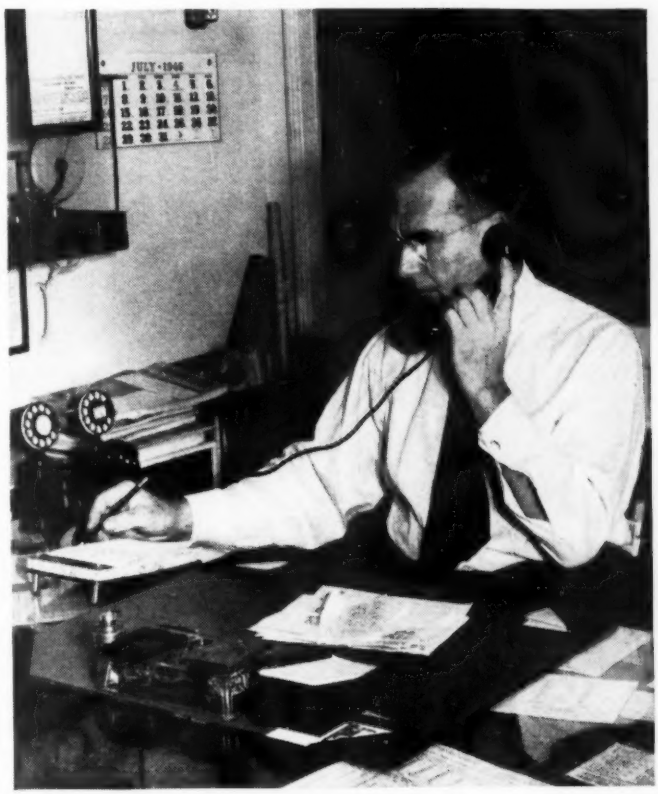
To operate and maintain this plant, all mechanical and electrical equipment in the hotel, and the building structure, requires an engineering department of 80-90 people—engineers, operators, machinists, electricians, carpenters, plumbers, and masons—virtually a complete roster of the trades.

If operation and maintenance were all, life would be fairly simple. But Lewis, a licensed professional engineer, supervises planning for extensions and alterations, and in his department lies full responsibility for all purchasing of mechanical and electrical equipment and supplies. Lewis' men prepare specs, secure prices, make decisions and write contracts—although Warren scores an assist for the lawyers who check contracts.

Such a job is no place for an amateur and when it comes to engineering, Lewis is professional in every sense of the word. After grade school in Brooklyn, where he was born, and high school at Greenport, L. I., he headed straight for Brooklyn's Pratt Institute, where he covered a combined mechanical and electrical course in three years, to graduate in 1910. But, as he says, "I've been going to school most of my life, both on and off the job". The off-the-job part consisted of courses in the evening departments at Brooklyn Poly, Columbia and Pratt —courses in various phases of the engineer's work where Warren felt a little "book larnin" would round out the experience he was getting in a succession of practical engineering and operating positions.

On-the-job training began with three years as special apprentice in the N. Y. Central's motive-power department and continued in Babcock & Wilcox's proposition department. Following operating experience with Brooklyn Edison and Bush Terminal, he was chief of New York's Bradstreet building for five years and assistant chief at the Metropolitan Life building for eight. His 17 years with the New Yorker began in 1929. During the period when the New Yorker was part of the Hitz chain, Lewis served as consulting engineer for the other hotels, tackling such assignments as the air conditioning of 250 guest rooms at the Adolphus in Dallas, a $100,000 job.

If Warren Lewis has a hobby outside of his job, it's N.A.P.E.



WARREN LEWIS directs mechanical and electrical operations of the 2500-room Hotel New Yorker from his office just outside of the sub-basement steam-and-diesel power plant

He was initiated into Brooklyn No. 8 back in 1914, and held every post "from doorkeeper up," as he puts it. No. 8 was one of several associations combined to form the present Greater New York Association No. 1, in which Warren plays an active part. In recent years his fellow engineers have honored him by electing him to high state and national posts in N.A.P.E., culminating in the national presidency.

His interest in sharing experience with brother engineers is as old and deep-seated as his interest in N.A.P.E.. Back at the time of World War I he wrote his first article, an answer to a reader's question in POWER, and his common-sense approach to engineering problems is now familiar to many readers of the technical magazines.

Asked about his philosophy of plant operation, Lewis said, "The good operating engineer doesn't lose his head. *Assuming that he knows his plant and his business,* he must learn by experience to sit tight and think things out when he finds himself in a jam. Nothing is more costly than a wrong answer put into action because it was the first that came to mind when the heat came on."

We put in italics the phrase "Assuming that he knows his plant and his business" because we think that's the key to Warren's success. To him it is a foregone conclusion that a good operator should know his plant and his business, because Warren Lewis *does* know them.

What make of steam generating equipment

During the past year all of the following well known paper companies have ordered or installed Riley Steam Generating Units

This decided preference for Riley equipment by the paper industry is typical of the growing preference for Riley equipment throughout all industries. The excellent reliable performance of Riley equipment has carried Riley to a position of leadership in the boiler industry.

Champion Paper and Fibre Co., Canton, N. C.
300,000 lbs./hr. 500 lbs. Pressure—750° F. Temp.
Fired by Riley Pulverizers and Burners

Penobscot Chemical Fibre Co., Great Works, Maine
200,000 lbs./hr. 475 lbs. Pressure—700° F. Temp.
Fired by Riley Pulverizers and Burners

Gaylord Container Co., Bogalusa, La.
210,000 lbs./hr. 525 lbs. Pressure—715° F. Temp.
Fired by Oil and Natural Gas

Upper Michigan Power & Light Co., Escanaba, Mich.
(Mead Corporation)
150,000 lbs./hr. 450 lbs. Pressure—650° F. Temp.
Fired by Riley Pulverizers and Burners

Waldorf Paper Products Co., St. Paul, Minn.
150,000 lbs./hr. 725 lbs. Pressure—700° F. Temp.
Fired by Riley Pulverizers and Burners

Rayonier, Inc., Port Angeles, Wash.
120,000 lbs./hr. 700 lbs. Pressure—740° F. Temp.
Fired by Oil

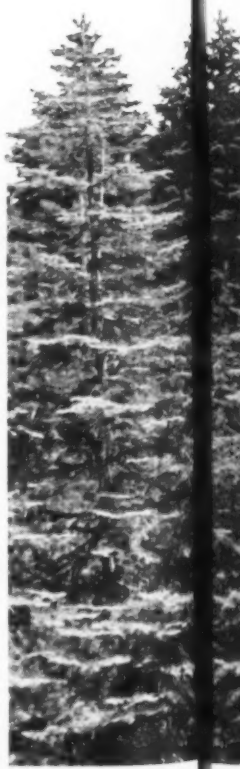
P. H. Glatfelter Company, Spring Grove, Pa.
140,000 lbs./hr. 650 lbs. Pressure—640° F. Temp.
Fired by Riley Pulverizers and Burners.

Northern Paper Mills, Green Bay, Wis.
100,000 lbs./hr. 700 lbs. Pressure—700° F. Temp.
Fired by Riley Pulverizers and Burners.

Bryant Paper Co., (Time, Inc.), Kalamazoo, Mich.
80,000 lbs./hr. 650 lbs. Pressure—750° F. Temp.
Fired by Riley Pulverizers and Burners

Chillicothe Paper Co., Chillicothe, Ohio
80,000 lbs./hr. 650 lbs. Pressure—750° F. Temp.
Fired by Spreader Stoker

Champion-International Co., Lawrence, Mass.
70,000 lbs./hr. 425 lbs. Pressure—625° F. Temp.
Fired by Riley Pulverizers and Burners



TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

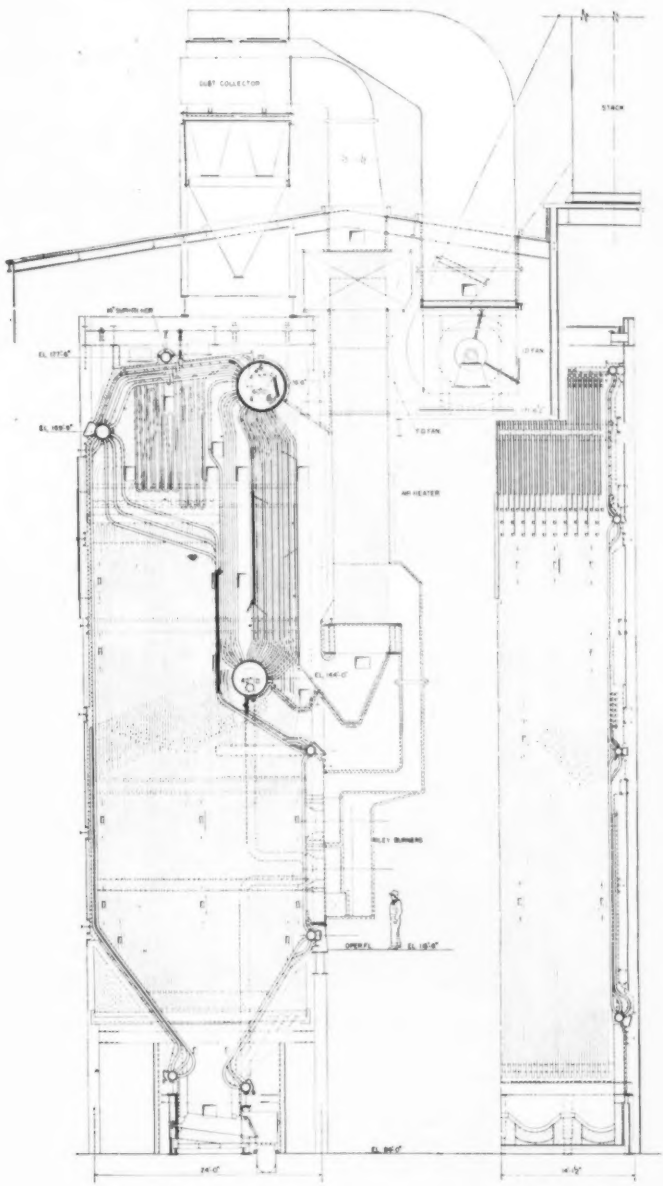
Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

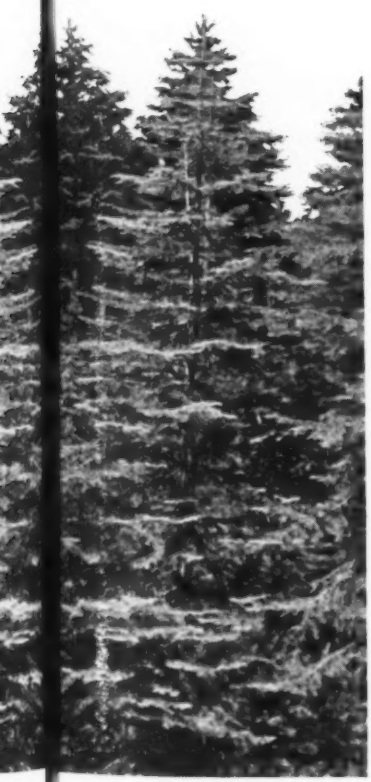
It will pay you to visit modern Riley Installations

is being installed in the Paper Industry today?

A Typical Modern Riley Steam Generating Unit

—an outstanding installation by an outstanding paper company





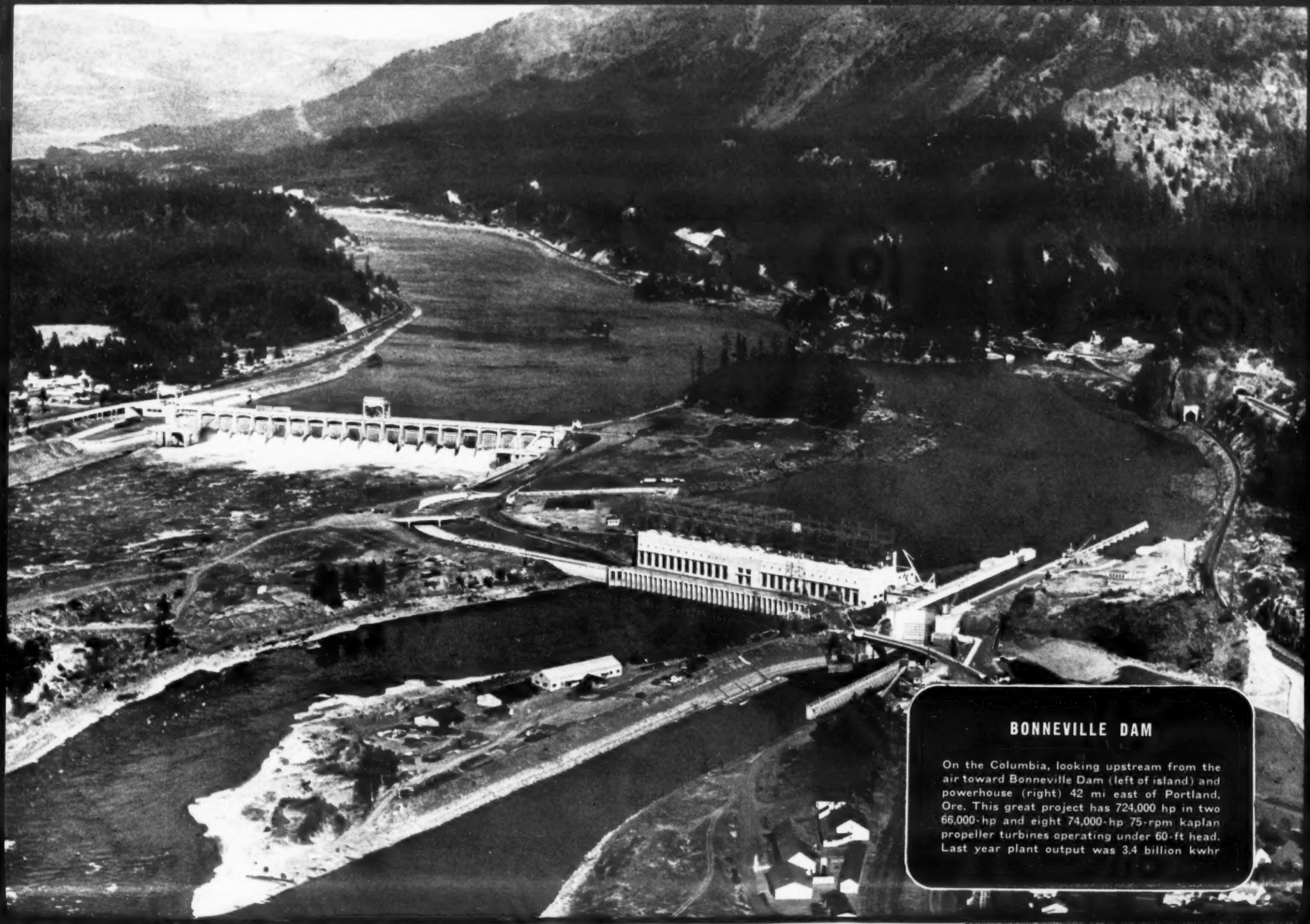
CHAMPION PAPER AND FIBRE CO., Canton, Ohio
300,000 lbs./hr. Riley Steam Generating Unit
500 lbs. Pressure—750° F. Temperature—86.6% Efficiency
Fired by Riley Pulverizers and Burners

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

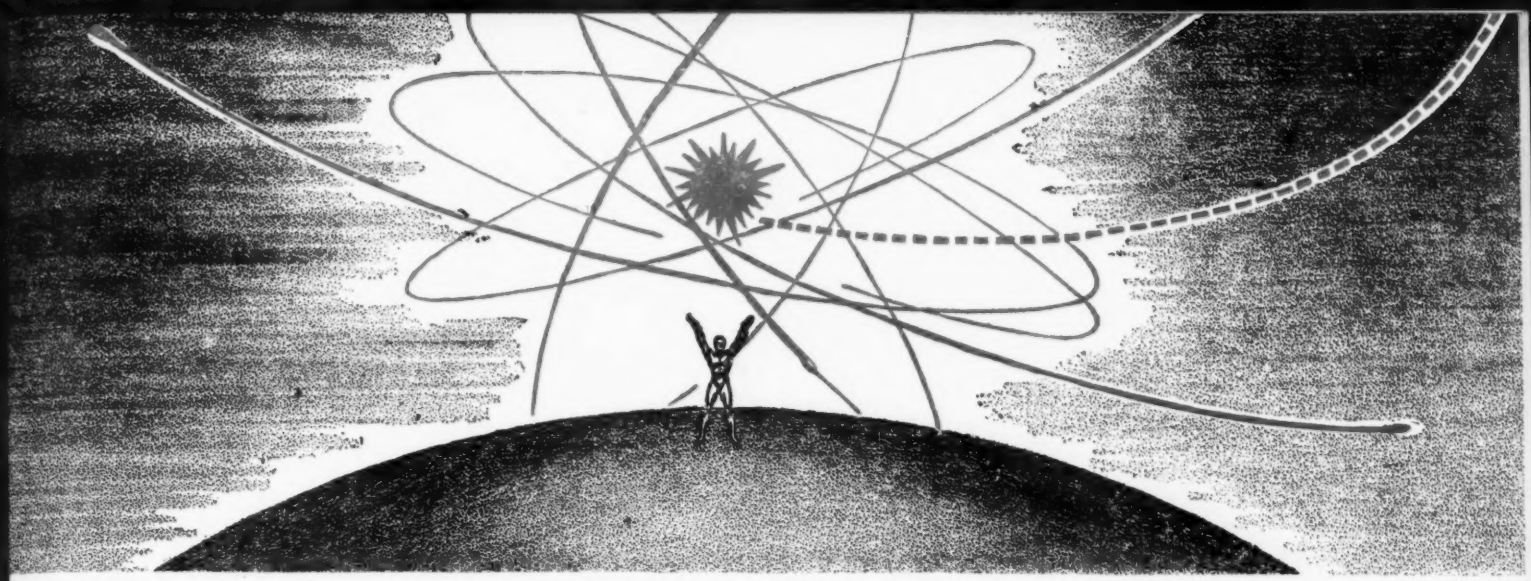
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment



BONNEVILLE DAM

On the Columbia, looking upstream from the air toward Bonneville Dam (left of island) and powerhouse (right) 42 mi east of Portland, Ore. This great project has 724,000 hp in two 66,000-hp and eight 74,000-hp 75-rpm kaplan propeller turbines operating under 60-ft head. Last year plant output was 3.4 billion kwhr



MAN vs ATOM—YEAR 1

WHEREIN WE SIGNALIZE THE FIRST ANNIVERSARY OF THE ATOMIC AGE, CONSIDER THE ALTERNATIVES INHERENT IN BOTH GOOD AND EVIL POTENTIALITIES OF NUCLEAR FISSION, THEN VENTURE A GLIMPSE INTO THE FUTURE

A YEAR AGO, July 16, 1945, at Alamogordo, New Mexico, man created the first atomic explosion. Most impressive events diminish in stature as they recede in time. This one grows bigger with each passing day. It truly marked the beginning of a new age.

As Year 1 of the Atomic Age ends and Year 2 begins, we are engaged in three portentous projects.

At Bikini Atoll we are detonating the fourth and, possibly, the fifth atomic explosions in the history of the world.

At Oak Ridge, Tennessee, we are building the first atomic energy plant for peaceful purposes.

Most important, in New York we and all the other United Nations are engaged in the first attempt to subject atomic energy to international control. Literally, the fate of the world hangs on this attempt.

As this introduction is written, the United Nations Atomic Energy Commission has just begun its work. People everywhere pray for its success—for their own sake, but even more for their children and for their grandchildren. If this Commission fails let everyone everywhere be warned: the world has taken a step toward destruction.

As we enter the second year of the Atomic Age, the nations of the earth are embarked on an atomic armaments race. There is no blinking that fact. We have had official notice served on us. Therefore, we must understand that unless the United Nations Commission can arrest the drift of events, we are moving toward a horrible war. The Commission must succeed.

The American delegate, Mr. Baruch, has brought to the Commission an ably thought out plan. It would internationalize nuclear science, and release for mankind the beneficent applications of atomic energy. But it would "control" atomic bombs only to the extent of giving the world brief warning of any nation's preparation to use them, so that we might have foreknowledge of disaster.

Therefore, the real and enormous task before the world becomes clear. We must end war. No other control of atomic weapons exists. If war comes, atomic weapons will be used. If they are used, our children who survive will curse their fathers. Understanding the consequences of failure, we *must* succeed.

Because we cannot succeed without knowledge, I have asked my associates at McGraw-Hill to condense into the following pages what we know at the close of Year 1 about this great new atomic force — its basic science, its possible uses and its political repercussions.

James H. McGraw, Jr.

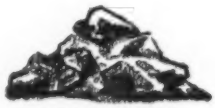
President, McGraw-Hill Publishing Co., Inc.

Copyright 1946 by the McGRAW-HILL PUBLISHING CO., INC., 330 W. 42nd St., New York 18, N. Y.

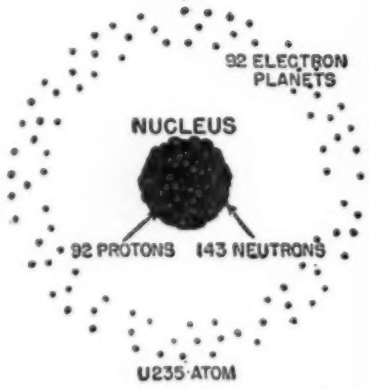
This Fateful Atom...

1 ORE TO U235

Only 0.7% of natural uranium is U235



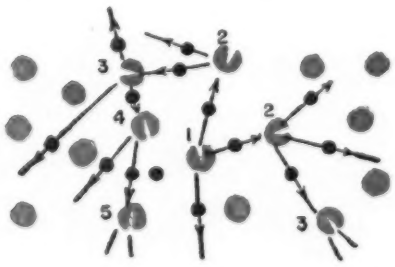
URANIUM ORE



U235 ATOM

2 CHAIN REACTION

Fragments from earlier nuclear explosions smash other nucleii



LOOKING BACK twelve months to the birth of Year 1, Atomic Age, we begin to sense the majestic import of the atomic bomb that blasted the naked desert at Alamogordo, N. M., on July 16, 1945. There man first shattered atoms in an explosive *fast-chain* reaction. Then came Hiroshima and Nagasaki.

In every case the fateful atom was either uranium 235 (U235), or plutonium derived from the action of U235 on U238. Every pound of U235 atoms split in these unprecedented blasts yielded the energy of 11.4 million kilowatt-hours, or 1400 tons of coal — slightly more for plutonium.

No matter where one mines uranium ore, the purified natural uranium (Fig. 1) always contains 99.3% of the "garden" variety U238, and a mere 0.7% of the precious U235.

An atom is like our solar system. The central sun is the nucleus — a bunched mass of protons and neutrons, each weighing one unit. The planets are electrons. Each proton has one plus electrical charge — each electron an equal negative charge. There must be as many negative electron planets as positive protons in the nucleus. This is also the "number" of the atom. Neutrons have no charge, but add weight.

The atomic number of uranium is 92 because the uranium atom always has 92 nuclear protons and 92 electron planets. The isotopes U238 and U235 differ only in the number of neutrons; U238 has 146 neutrons, and weighs $92 + 146 = 238$ units. U235 has 143 neutrons, and weighs $92 + 143 = 235$ units.

Ordinary chemical reactions, such as TNT explosions, release only a fraction of the modest energy of the whirling electrons in the outer atom. Nuclear reactions unlock the immensely greater energies which bind together the nucleus.

Even the gentle tap of a slow-moving neutron bullet will split the atom of U235 or of man-made plutonium into two medium-weight atoms, yielding also one to three spare neutrons plus energy. Thus these *fissionable* materials supply both their own bullets and a highly sensitive lot of high-explosive targets — a perfect setup for a *chain reaction* (Fig. 2).

Chain reactions work like chain letters. Neutrons from one nuclear explosion hit and explode other nuclei. But, since atoms are mostly open spaces a chain started in a small block of U235 or plutonium quickly dies out because most of the released neutrons escape from the block.

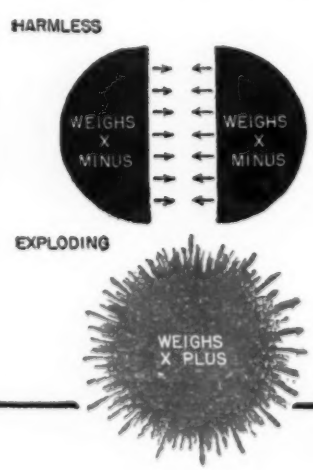
The bigger the block, the smaller will be the percentage of escaping neutrons, and the more left to split other nuclei. When the block is rapidly built up beyond a certain secret size the fragments of 1000 nuclear fissions split many more than 1000 additional nuclei. Then fissions multiply geometrically, and the block disintegrates with explosive speed and violence — as in a bomb (Fig. 3).

This bomb explosion is a fast-neutron chain. For economy and ease of control, uranium piles for the gradual release of nuclear energy for commercial purposes will normally use a lean fuel — that is U235 or plutonium diluted with U238, thorium or other less costly materials.

To maintain a chain reaction such piles must be large and artificially stimulated by using carbon blocks or some other *moderator* (Fig. 4) to slow many of the neutrons. Slow neutrons make more hits than fast neutrons because there is more time for them to be swerved from a straight path by the attraction of nearby nuclei, as shown below.

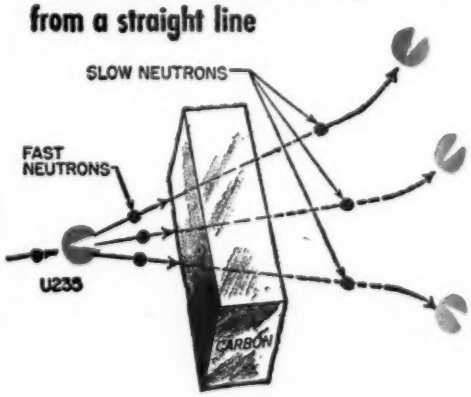
3 WHY BOMB EXPLODES

When block of rapidly assembled U235 passes secret critical size it explodes spontaneously



4 SLOW NEUTRONS MAKE MORE HITS

A slow neutron is more easily swerved from a straight line



can Serve Man . . .

THE FATEFUL U235 ATOM can serve man as a new, compact source of heat energy for power generation, comfort heating or industrial processing. Peacetime applications of atomic energy will use dilute U235 or plutonium as a "fuel," mixed with carbon or some other moderator to slow some of the neutrons and thus keep the chain reaction going.

The diluting agent may be either U238 or thorium, or both. These will do double duty, because neutron bullets convert U238 into the energy-yielding plutonium, and thorium into U233, which may prove equally serviceable.

Thus the commercial piles of the future will "burn" U235 to make other atomic fuels, plutonium and possibly U233, which in turn will deliver heat energy to the pile. In that way it will be possible to get from the pile far more heat than the equivalent of 1400 tons of coal for each pound of U235 split. This highly attractive prospect will speed the day when nuclear energy can compete with coal.

While already mechanically obsolete, the piles making plutonium for bombs at Hanford, Wash. (Fig. 1) reveal the basic principle on which future piles for power and heat will operate. The heat now wasted in vast quantities will be put to work. The plutonium, now removed for bomb manufacture, will be returned to the pile (or left in) as supplementary fuel.

ATOMIC POWER

The possible everyday applications of nuclear heat pictured in Fig. 2 have been recognized from the very first day of the Atomic Age. Year 2 will see the building of the world's first atomic power plant (a pilot plant) at Oak Ridge, Tenn.

Beyond question such installations will produce power, but it may be years or decades before they prove economical. To compete with conventional plants the piles must first be redesigned to run at temperatures high enough for good power-plant efficiency. Also the techniques of operating piles by remote control through the heavy radiation screens must be radically streamlined.

The Hanford piles run on natural uranium containing only 0.7% of U235. The typical commercial atomic power plant of the future will use more than 0.7% of U235 or plutonium, but less than 50%. This will avoid both the low efficiency of the too-lean mixture and the excessive fuel cost of the rich mixture. It will permit piles of moderate size and take maximum advantage of U238 and thorium as potential sources of plutonium and U233.

One should not expect U235 to replace coal generally in this generation, although a few central power stations and ships will try it out before Year 10 of the Atomic Age. Plants far from traditional sources of fuels may turn much sooner to uranium and thorium as concentrated heat sources, that may easily be transported even to remote corners of the earth.

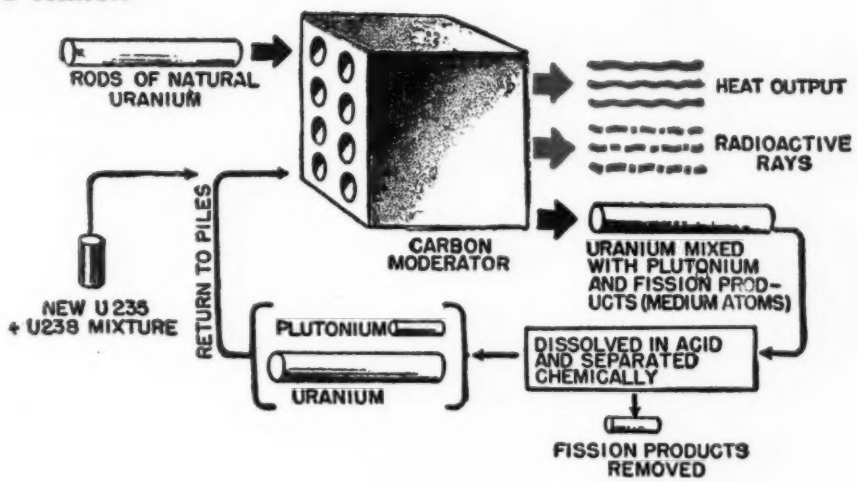
Atomic power, in forms now known, is impracticable for automobiles and small airplanes, because of the large initial investment in uranium and the need to carry 50 tons of shielding to protect riders and pedestrians against the deadly radioactivity accompanying nuclear fission.

RADIOACTIVE ISOTOPES

More immediately important than the heat and power applications of nuclear energy are the services that the radioactive byproducts of pile operation can render. Because these materials act chemically like their ordinary non-radioactive cousins, but can be followed and detected easily, they are expected to play tremendously vital parts in medicine and biology. For more details, see the last page of this section.

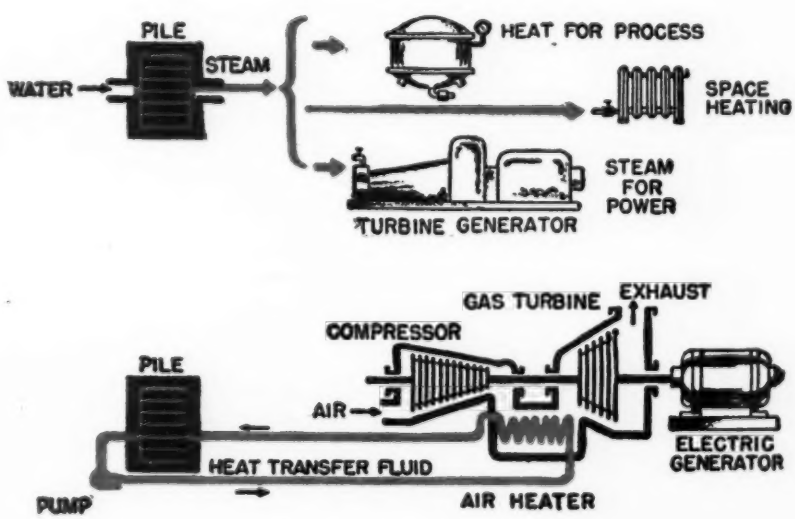
1 SLOW-NEUTRON PILE

Can make plutonium for bombs—or heat for power, process and comfort

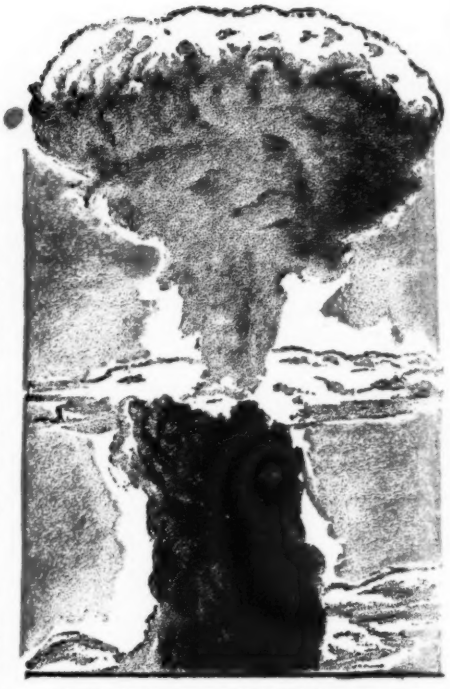


2 PRACTICAL APPLICATIONS

Include steam for turbines, process and comfort heating—also heat for gas turbines



or Destroy him . . .



A single improved atomic bomb can devastate ten square miles of city

URANIUM 235 and plutonium are now man's slaves. They will build or destroy as he orders. Man dreads this vast force only because he distrusts himself. War is proof that man in the mass has never achieved self-control. He has always sought better weapons; yet the perfect weapon now brings him no satisfaction for he sees in the atom bomb his own destruction as well as that of his enemy.

The ultimate benefits of nuclear energy may well surpass its present terrors, but the terrors are here now in awful dimension, and man must face them. He must pay this price for unlocking the wealth of the inner atom.

ATOMIC BOMB

This page, then, is about the atomic bomb. Nothing will be said here that is not either a certified scientific fact or a conclusion shared by the majority of the leading scientists, engineers and statesmen who have studied the matter.

As already explained, an explosive nuclear chain reaction spontaneously sweeps through a block of U235 or plutonium when the block is rapidly enlarged beyond a certain "critical" weight X. That weight is still a military secret; the official Smyth report vaguely suggests that it is more than 4 lb and less than 200 lb. Each piece of U235 in the dormant bomb must weigh less than X. At the desired instant of explosion the bomb mechanism assembles these pieces rapidly into a single piece considerably heavier than X.

The explosion itself drives the U235 pieces apart, thereby quenching the atomic conflagration before all the atoms are split, so the bomb efficiency is far less than 100%. For each pound of U235 (or plutonium) atoms actually split, the bomb releases the energy of 1400 tons of coal.

This explosion is mainly ordinary heat at work in unprecedented concentration. Bomb metals become incandescent vapor millions of degrees hot. This, and the enveloping sphere of glowing air, radiate a blinding flash that chars human flesh at half a mile and blisters at over a mile. There is a destructive shock wave (sound) and a second-long hurricane of unimaginable force — the outrushing of the expanding heated air. Deadly neutrons and gamma rays speed out from the bomb.

A single atomic bomb killed about 100,000 at Hiroshima. Fewer died at Nagasaki only because the circle of potential destruction included much vacant land. Bombs ten times more powerful can be made by the thousands in any major industrial country with the plants and the know-how. One bomb could saturate Minneapolis or downtown Manhattan.

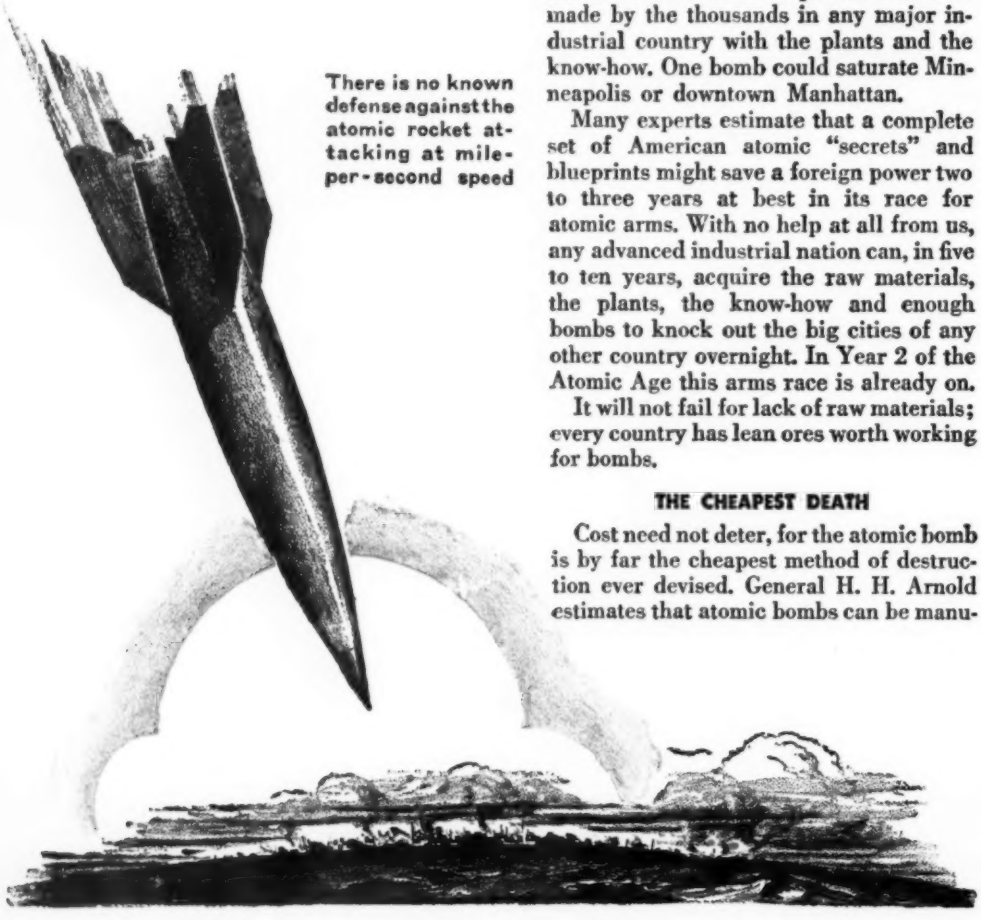
Many experts estimate that a complete set of American atomic "secrets" and blueprints might save a foreign power two to three years at best in its race for atomic arms. With no help at all from us, any advanced industrial nation can, in five to ten years, acquire the raw materials, the plants, the know-how and enough bombs to knock out the big cities of any other country overnight. In Year 2 of the Atomic Age this arms race is already on.

It will not fail for lack of raw materials; every country has lean ores worth working for bombs.

THE CHEAPEST DEATH

Cost need not deter, for the atomic bomb is by far the cheapest method of destruction ever devised. General H. H. Arnold estimates that atomic bombs can be manufactured *and delivered* for less than $500,000 per square mile of destruction.

Don't be misled by the two billion dollars America spent on a project that dropped only two bombs on the enemy. New plants can be built at a fraction of wartime cost, and the investment spread over thousands of bombs, not just two.



There is no known defense against the atomic rocket attacking at mile-per-second speed

NO DEFENSE

So the bombs can be made in ample quantity and paid for, but can they be delivered? The answer is: "Yes; by the time the bombs are ready they can be delivered anywhere and overnight." If the defenses of the target country are weak, piloted planes can get through in ample number. Ten percent would be enough.

For more effective delivery radio-steered pilotless planes and rockets can carry the atom bombs faster than sound. Such weapons will be almost untouchable by either antiaircraft artillery or manflown fighters.

Greatest threat of all will be the transoceanic rockets. The German V-2 rocket, which never once was stopped by Britain's defenders, points one way. It needs only transatlantic range (with atomic propulsion) and an atomic bomb in the nose. Forty-six feet long, loaded with 7500 lb of alcohol fuel and 11,000 lb of liquid oxygen, the V-2 of World War II rose 60 miles in the air and arced 200 miles in five minutes to deposit one ton of TNT in London.

Seeing so many strange things come to pass, the man in the street cannot distinguish between possible miracles and the impossible variety. From the very start of the Atomic Age he has been hoping for a "ray" that will explode the atom bomb far off. Competent scientists and engineers say that cannot be.

The only way to bring down a 3500-mile-per-hour rocket at a safe distance is to chase it with your own 4000-mph rocket. You can't win at this game often enough to establish ironclad protection.

The only specific defense against the atomic rocket known in Year 2 of the Atomic Age is to disperse all cities and put key industries underground. This would be very costly in time, money and national morale.

MORE AND BETTER BOMBS?

Some will ask whether the U.S., as the most powerful industrial nation, could not build more and better bombs and carriers than any other nation. Probably yes, but there is still no real security. If the "weak" opponent has enough atomic weapons to destroy us once, what advantage is there in being able to destroy him twice?

Shooting first could protect us now, but not after the world is atomically armed. If we were to destroy the enemy's cities, we would probably miss his well-concealed and protected bomb magazines and rocket launchers. A few minutes later he could return the atomic fire. In brutal simplicity, that is the picture of future atomic war. Everybody loses.

At this point one grasps at another straw: "If everybody is to lose who would be so foolish as to start an atomic war? And didn't the Germans refrain from using gas for a similar reason?" Possibly yes. It *may* work that way. But in a world atomically armed to the teeth some nervous finger *may* pull the fatal trigger.

ONLY ONE WAY OUT

Throughout history each new offensive weapon has called out its appropriate defense. But now the offense leaps centuries ahead in a single bound and the defense lies almost helpless everywhere, unless some technical protection, unknown as Year 2 begins, can be devised.

The situation is extremely dangerous. There is no clear way out except through some sort of international action first to stop the atomic arms race and, before it is too late, to hobble war itself.

Can it be done? Perhaps not, but there is no alternative except atomic chaos.

...so he faces the Atomic Dilemma...

THE NUMBERED statements that follow in somewhat logical pattern are too fateful to be accepted on anybody's say-so. Every reader should test them in the light of his own information and understanding.

The points below sum up the conclusions of the previous article — and these in turn reflect a great mass of thought and discussion among leading scientists, engineers and statesmen close to the problem. To an amazing degree they concur on both facts and conclusions. For authoritative statements of their line of thought, in detail not possible here, the reader should see the recent book, *One World or None.*

THE DILEMMA

Nations must either face the probability of an atomic World War III, which would surely be the most deadly in history . . .

***Or,* the experts propose, yield both atomic weapons and war potential to international authority backed by superior force.**

What the Experts Say

1. In five to ten years any major industrial nation can make enough atom bombs to destroy all the major cities of any other country overnight.

2. This assumes no "secret" information or other help from us.

3. The necessary uranium ores will be at hand.

4. The cost will not be too high.

5. The bombs produced can then be carried thousands of miles by bombers, or by atomically powered guided missiles moving faster than sound.

6. There will probably be no effective military defense against such weapons.

7. Dispersing cities, and putting key industries deep underground, will give some protection if accomplished in time, but at incredible cost in money and human discomfort.

8. In a world atomically armed, nations can probably protect their bomb stocks and rocket launchers from enemy assault.

9. If so, nation A can destroy the cities of any other nation B, after which B's rockets will destroy the cities of A. Shooting first will not win an atomic war.

10. This knowledge may not restrain the trigger finger of a suspicious power.

11. Having more and better atomic weapons than the other fellow won't help much if he has enough to destroy us. No use to kill a man twice or rebomb urban ruins.

12. Every nation is vulnerable in the Atomic Age, including the U. S. A.

13. National security will be impossible without (first) international control of atomic arms and (not too long thereafter) international control of all war potential, both backed by superior physical power.

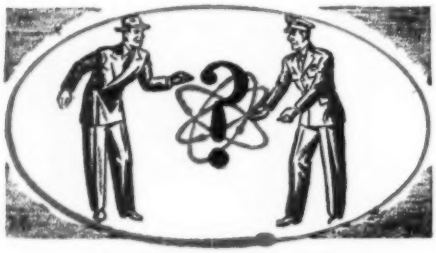
14. If action to this end is long delayed, it may become impossible to halt the atomic arms race already started.

15. At best, the necessary degree of international control, with some real delegation of national sovereignty, will be a revolution in human affairs. It may prove to be humanly unobtainable at this time. If so, men and women everywhere must face the probability of an atomic third world war—by far the most destructive in all history.

In this atomic age no nation can be safe through its own unaided might

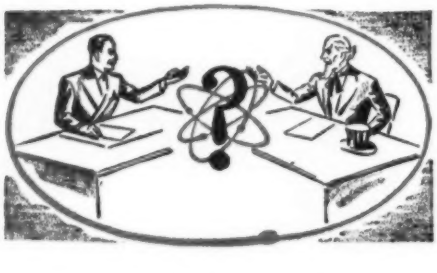
...and the Great Debate unfolds

ATOM YEAR 1 has probably been marked by more debate on a single subject than any other twelve months in the world's history. Social, economic and political as well as purely technical issues have been pressing for realistic solution. Let us look at these issues and see where we stand:



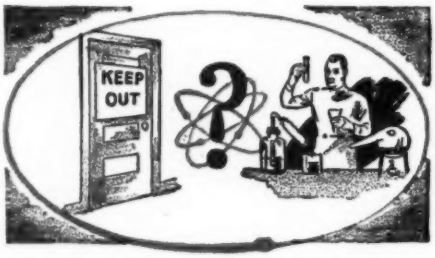
CIVILIAN VS. MILITARY

Because the atomic bomb is the world's greatest weapon, the armed forces would like to control it. But because atomic energy can also be used for peaceful, beneficial purposes, civilian control seems equally essential. These conflicting viewpoints had their strong proponents before the Congress which finally reached a fairly satisfactory compromise in the Atomic Energy Bill of 1946, setting up a competent civil board with which the armed forces will have continuing liaison. As we go to press, just before Year 2 of the Atomic Age begins, this bill has passed the Senate, but there is still a question how rapidly it will be enacted into law.



PRIVATE VS. PUBLIC

Atomic energy is "too big" and "too hot" to be handled privately. It must be nationalized and internationalized. The questions are *how* and *to what extent.* Fortunately, as the "boxes" on these pages show, there are means that may attain reasonable safety against misuse of the atom, and still do so without public control of many "non-dangerous" applications.



SECRECY VS. FREE SCIENCE

Throughout the first year of the Atomic Age hot debate has raged around "keeping the secret of the bomb." To prevent potential enemies from making atom bombs some have urged a complete blackout of all phases of atomic energy — even of the scientific fundamentals of nuclear physics. Others have sought immediate and complete disclosure of all bomb "secrets," both scientific and technological. These have held that such information cannot be effectively hidden, that secrecy blocks progress and breeds wars.

A year of debate has brought the great mass of vocal opinion to this middle ground: (1) Ease restrictions on the exchange of basic physical knowledge. (2) Release for industry's benefit many of the devices and methods developed for the bomb project. (3) Hold tight to specialized information on atomic bombs and bomb-material production until international safeguards are fully operative.

DOMESTIC CONTROL AS PLANNED IN THE ATOMIC ENERGY BILL OF 1946

McMahon Committee Bill contains the following provisions.

Policy. Declares it the policy of the U. S. to develop and utilize atomic energy to improve the public welfare, increase living standards, strengthen competitive enterprise and promote world peace.

Organization. Establishes the Atomic Energy Commission (AEC) of five administrators to direct four divisions on research, production, engineering, and military applications—to work in liaison with three committees from (1) the armed forces, (2) outstanding civilians, and (3) joint Congressional representatives.

Production. AEC to own and operate (under management contracts with industry if deemed desirable) all facilities for the production of fissionable materials, such products to be distributed with their radioactive byproducts under license for private industrial and medical research.

Military Application. AEC to engage in development work and produce atomic bombs as directed by the President, to be delivered only on his order to the Armed Forces.

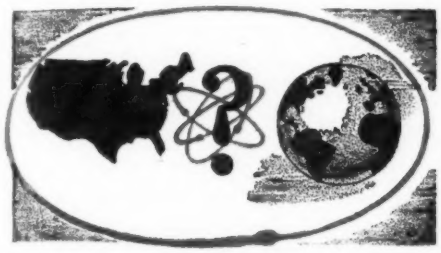
Industrial Utilization. Permits AEC to conduct research, design and manufacture equipment for atomic-energy utilization, license its use, produce and sell power obtained as a byproduct in the production of fissionable materials. Directs AEC to give widest safe scope to private initiative.

Control of Information. AEC to enforce a ban on the dissemination of restricted data that might be used to injure the U. S. or secure advantage to a foreign nation, yet to provide leeway for ultimately relaxing restrictions as future conditions warrant.

Patents and Inventions. No private patents permitted for production of fissionable materials or their utilization for military weapons, but AEC will justly compensate for such inventions, when made by private citizens. Patents for non-military applications may be purchased or condemned by the AEC only when public interest is affected.

Appropriations. "Such sums as may be necessary and appropriate to carry out the purposes and provisions of the act" *plus* unexpended funds of the Manhattan Engineer District.

while Time runs out



NATIONAL VS. INTERNATIONAL

Born of nationalism, the Atomic Age began when three nations discovered a weapon that today gives them the greatest military power on earth. The prime question is: Shall the atom remain the servant of its conqueror, nationalism?

During Year 1 of the Atomic Age the Truman-Atlee-King declaration, the masterly report of the State Department's atomic consultants, and the U.S. representative on the United Nations Atomic Energy Commission, have all called for international control of atomic energy. Year 2 will start with no such control. This failure to decide and act is in part a natural result of the extreme difficulty of the problem and the obvious dangers of unwise decisions. Nations everywhere face a triple dilemma in this Atomic Year 2: the dangers of nationalism, the dangers of internationalism, the supreme danger of not being able to make any decision in time to meet the atomic bomb threat.

INTERNATIONAL CONTROL AS PROPOSED BY THE U.S. TO U.N. ATOMIC COMMISSION

Baruch statement follows constructive path laid out by Atomic Consultants in "Acheson-Lilienthal Report."

The Plan. The U.S. has proposed that all nations band together to outlaw the use of atomic energy for war and to promote and harness its development for the benefit of mankind. To this end an International Atomic Development Authority would be set up, and to it the U.S. would turn over, at various stages of its organization, all atomic bombs, know-how, raw materials, facilities, and stockpiles of fissionable material. Thus IADA eventually would supersede national authorities on some matters and supplement them on others.

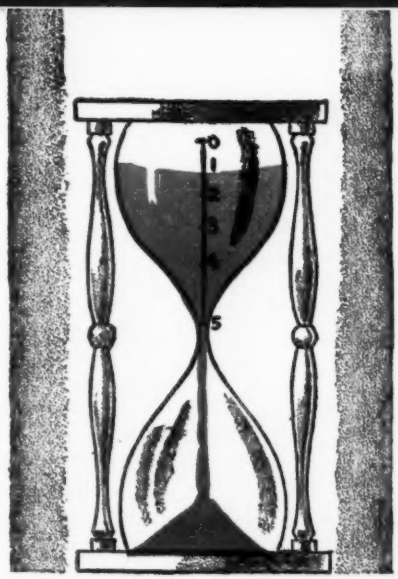
Owner and Operator. IADA would take over from national authorities or private ownership full management and control of all atomic energy matters that afford a possible threat to World security. These include:

1. Raw Materials—Supplies of uranium and thorium to be inventoried, controlled, and developed by IADA.
2. Facilities—IADA to control and operate plants producing fissionable materials and to own and control their products.
3. Research—IADA to undertake research and development on all aspects of atomic energy and to possess exclusive right of research on atomic explosives.

Private Initiative. Will have its chance to push forward the use of atomic energy for peacetime (non-dangerous) purposes. With IADA providing raw materials and carrying out necessary inspection, national and private enterprise may operate "safe" power piles, and produce and use radioactive isotopes for research, clinical and other applications. Radioactive isotopes produced by IADA also can be distributed for peacetime use.

The Mechanics of Safety. No plan is a certain guarantee against future atomic war. This plan should, however, prevent surprise attack with atomic weapons; for IADA is to buttress positive ownership or management controls with wide powers of inspection. Obviously, successful inspection rests on complete freedom of access or egress in any area.

Sanctions. At the heart of the plan lies the problem of penalty for violation — a matter for profound statecraft. To the U.S., one aspect of sanctions appears crystal clear: Here is an area where the veto right now held by the five great Powers must be redefined if it is not to be incompatible with the meaning and purpose of the proposed control.



Leading industrial nations can produce atomic bombs in five years, competent scientists announced after Hiroshima. Already one year of the precious five has been consumed in debate without international action. Soon it may be too late to check the growing momentum of the atomic arms race.

TIMETABLE—ATOM YEAR 1

1. **July 16, 1945.** World's first atomic bomb detonated in New Mexico.
2. **July 26, 1945.** President Truman and Prime Minister Churchill issue Potsdam ultimatum threatening Japan's destruction if she continues.
3. **August 6, 1945.** Atomic bomb dropped on Hiroshima.
4. **August 9, 1945.** Atomic bomb hits Nagasaki.
5. **August 11, 1945.** Army releases Smyth Report on "Atomic Energy for Military Purposes."
6. **August 14, 1945.** Japan accepts terms of Potsdam declaration.
7. **November 15, 1945.** Truman-Atlee-King issue declaration of intention and procedures looking toward international control of atomic energy by United Nations.
8. **March 28, 1946.** State Department issues Acheson-Lilienthal Report on the "International Control of Atomic Energy."
9. **April 12, 1946.** Manhattan Engineer District announces program for experimental development of atomic power.
10. **June 1, 1946.** "Atomic Energy Bill of 1946" passes Senate unanimously, is referred to House of Representatives.
11. **June 14, 1946.** First meeting of United Nations Atomic Energy Commission (Bernard Baruch as American member). Manhattan District announces availability of radioactive isotopes for research use.
12. **July 1946.** Joint Army-Navy tests of atomic bombs at Bikini.

. . . but if Man Masters Atom . .

IF MUTUAL DESTRUCTION by the atomic bomb can be avoided, the first century of the atomic age will bring immense advances in scientific knowledge, health and living standards. Already many prospective benefits can be outlined, but those we can neither foresee nor suspect may be even more important.

This prediction is grounded in scientific experience; the most fundamental discoveries have always been the most fruitful. The study of molecules gave us chemistry. Faraday's experiments with electricity and magnetism are the foundation stones of the great electrical industry. Can one expect any less from an understanding of the heart of every atom?

BENEFITS

Atom-splitting benefits clearly visible today fall mainly in three classes: (1) heat and power applications of the uranium piles; (2) general industrial applications of equipment and methods originally developed for the bomb project; (3) chemical, biological and medical uses of the "tagged atoms" (radioactive isotopes) now abundantly available from pile operation.

It is now evident that the energy yield of the U235 in an atomic pile can be multiplied many times by returning to (or leaving in) the pile the plutonium and possibly the U233 produced respectively from the U238 and the thorium in the pile. This is an indirect way to "burn" inexpensive U238 and thorium, and thus greatly extend the supply and reduce the cost of atomic fuels.

POWER APPLICATIONS

Although present piles run at low temperatures, it is certain that temperatures high enough for the efficient operation of steam and gas turbines will be attained. Already an experimental atomic power plant has been ordered. Atomic power for certain remote installations (say, for heating Arctic airports) may not be far off.

In five or ten years uranium piles will be driving a few experimental ships and submarines. In 20 or 30 years uranium may begin to compete widely with coal as a fuel for suitably situated large central heating and power plants. The 50-ton minimum weight of shielding rules out nuclear power for automobiles and small piloted planes.

SPECIAL USES

Some day ultra-high temperatures from splitting atoms will be used for special industrial operations on metals and other materials. Even the dread atomic bomb might easily serve peaceful ends — blasting lakes in deserts, changing the course of rivers, leveling mountains.

INDUSTRIAL BYPRODUCTS

The special industrial equipment and methods developed for the bomb project will find hundreds of important uses — mostly for purposes unrelated to atomic energy. These developments include pumps with neither seals nor leaks, leak detectors of amazing sensitivity, ultratight welding, a portable mass spectograph for quick and automatic gas analysis, new ways of handling corrosive and poisonous materials, new diffusion barriers for the separation of gases and of petroleum products.

TAGGED ATOMS

Yet more important than any of these, in the long run, will be the hundreds of radioactive isotopes now available as by-products of pile operation. Chemically indistinguishable from the ordinary forms of the elements, these isotopes serve as tagged atoms or "spies" if mixed with common stable atoms of the same species. They "fly with the flock," and can later be identified as surely as banded birds. With these amazing tools of research, the course of any element or compound may be traced through the bodies of men, animals and plants. Similarly, tagged atoms may be used in studying the course of many kinds of industrial and chemical operations.

BIOLOGY AND MEDICINE

A suspected hyperthyroid condition can be diagnosed by feeding the patient a minute measured amount of radioactive iodine. The click of a "Geiger" counter placed on the patient's neck will tell (1) what percentage of the swallowed iodine concentrates in the thyroid cells and (2) how rapidly that concentration is accomplished — giving a definite indication of the state of the gland.

In similar fashion the radioactive isotopes of hydrogen, oxygen and carbon will trace out the intricate transformations of carbohydrates and proteins in the human body. Radioactive phosphorus will explore the bones. Radioactive iron will show how and where blood cells are formed. Radioactive sodium will time the circulation of blood.

USES IN INDUSTRY

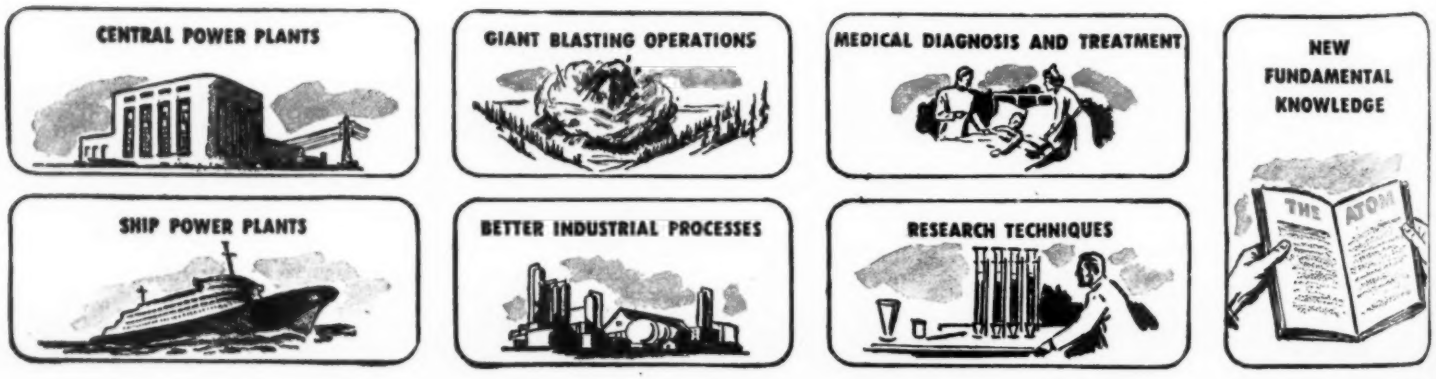
In chemistry the radioactive isotopes will speed the understanding of metallurgical and organic reactions. In industry they will measure flow, detect leaks, and do other useful work.

Meanwhile the uranium piles will be manufacturing certain radioactive isotopes that can serve as cheap but effective substitutes for high-cost medical radium.

KNOWLEDGE COMES FIRST

It is already clear that the chief benefits of atom splitting will come first as new scientific knowledge rather than as new engines and gadgets. But in the long run man's new understanding of the inner atom will enrich the whole range of human activity. This has always been the case with less fundamental discoveries in science. It can hardly be less with this most fundamental discovery.

ATOM SPLITTING WILL SERVE MAN IN:



Busbar Spacing Creates Unbalanced Circulating Current In 3-Phase System

Long bus runs with flat equal spacing create an unbalanced circulating current between generators and motors in low-voltage distribution systems. L G Levoy Jr, industrial engrg div. of General Electric Co, tells why these conditions exist and how to correct them

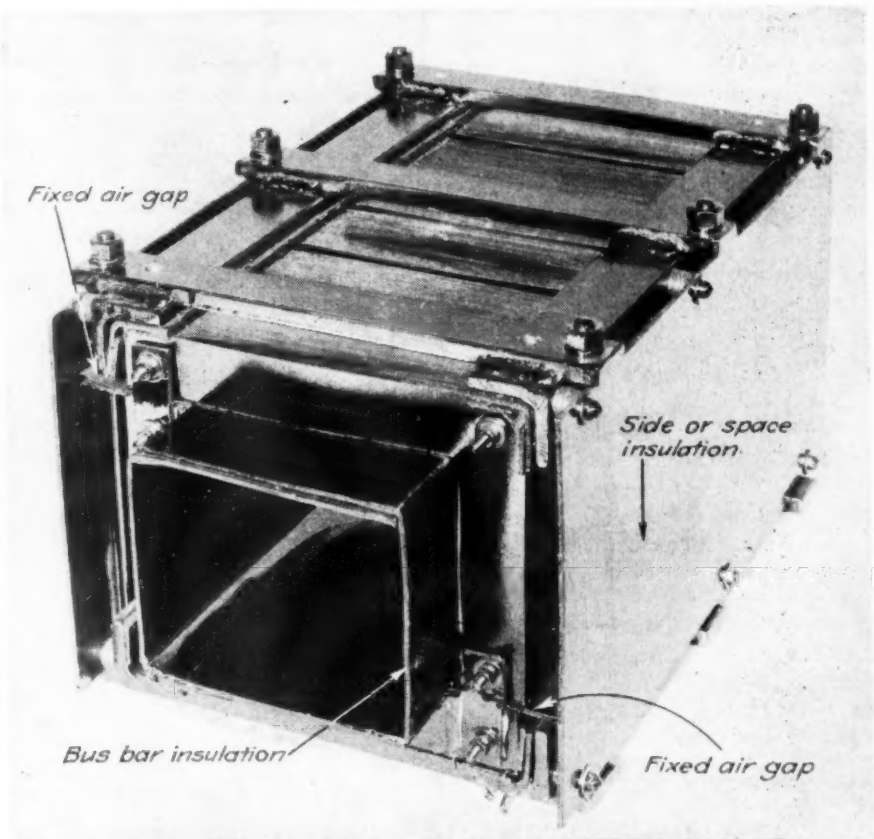


Fig. 1—Series reactor added to the middle leg of the generator bus for a 3750-kva 3-phase 60-cycle 600-volt turbine-generator to balance the phase currents

► SMALL INDUSTRIAL PLANTS frequently generate their own electrical power at 600 volts or less. They generally distribute and use the majority of this power at the generated voltage without transforming it. In some of these plants, where low-voltage generation and distribution is used, observations show that the three phases of the generator are carrying different currents, which cannot be eliminated by shifting or removing all single-phase loads. These unbalanced currents are the result of busbar unbalance, which is particularly noticeable in plants where the main load consists of motors operating directly from the generator bus without intermediate transformers.

Unbalanced generator phase-current values of 5 to 10% have frequently been observed in such plants. This is particularly objectionable where non-salient-pole or round-rotor turbine-driven units are used since current unbalance causes additional field heating inside the machine. This additional heating is usually less severe in salient-pole machines.

CAUSE OF UNBALANCE

When a turbine-generator is carrying a balanced 3-phase load, the magnetic flux in the rotor is constant except for minor ripples caused by tooth-and-slot effects. However, when the stator current is unbalanced in the three phases, the rotor flux tends to pulsate at twice normal frequency. This generates relatively severe eddy currents in the rotor structure, causing added heating and, sometimes, burning of rotor wedges. In severe cases, the rotor may be badly damaged from overheating even though the generator is carrying less than rated load. Generator loading must be reduced to avoid excessive heating when this unbalanced current flows.

In addition to the effect on the generator, the unbalanced current causes similar overheating in motors. It also reduces their available peak torque and decreases their efficiency. Consequently, in the interests of good service and good system operation, it is desirable to keep the phase currents as closely balanced as possible.

Several cases of phase-current unbalance were investigated, and each revealed that trouble was caused by relatively long runs of busbars mounted side by side in one plane. This flat, equal busbar spacing introduces a dissymmetry in the circuit. The three phases of the bus do not have equal inductance and impedance because space between the two outer busbars is twice that between the middle bar and either of the other two. Although the difference in reactance may be small, it causes an unbalance in voltage.

These unbalanced voltages are composed of two balanced, symmetrical components: (1) the ordinary positive-se-

quence voltage and (2) a symmetrical negative-sequence component, which is usually small compared to the positive-sequence voltage. It happens, however, that motors and generators have relatively low impedance to this negative-sequence voltage; therefore a small negative-sequence component of voltage produces a relatively large negative-sequence current. Consequently, the effect is magnified so a small negative-sequence voltage appears as a larger percentage of unbalanced current than the percentage of voltage unbalance that exists. The effect is especially noticeable where motors and generators are connected by unbalanced bus runs without intermediate transformers.

TRANSFORMERS HELP

When transformers are used between motors and generators, both the positive- and negative-sequence impedance of the circuit are increased by equal amounts so the unbalance is not so pronounced as described above. In static loads, of heaters for example, the positive and negative-sequence impedances are equal and the negative-sequence current is not amplified.

When severe unbalances of current are found to exist because of long low-voltage bus runs with flat equal spacing, they are usually corrected most readily by adding some reactance in series with the middle leg of the bus, thereby balancing the reactance in three legs. A simple way of obtaining this reactance is by installing a set of laminated silicon-steel punchings around the middle leg of the bus, as shown in Fig. 2, with an air gap to prevent saturation.

TROUBLE CORRECTED

This trouble was corrected in one plant with a 3750-kva 3-phase 60-cycle 600-v turbine-generator used to drive a group of induction motors. The generator bus was 100 ft long, consisting of channel busbars with flat horizontal spacing on 11-in. centers, Fig. 3. Feeder taps to motors were made from a small cross bus connected at the end of the generator bus run. The generator could carry only about two thirds of rated load without overheating. Currents in the three legs of the generator bus were checked and found to be respectively 2400, 2600 and 2500 amp. The middle leg was carrying the highest current. A series reactor was added to the middle leg of the generator-bus assembly, Fig. 1. The reactance was adjusted by changing the length of punching stack until currents in the three bus legs were equalized, and the generator

(*Continued on page* 144)

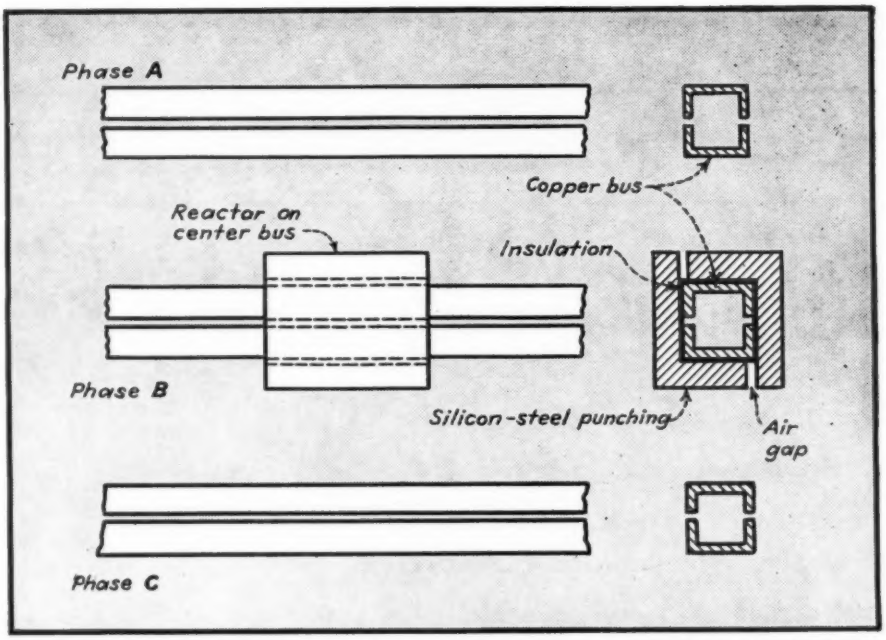


Fig. 2—Phase currents are balanced by adding a set of steel punchings to increase reactance of center leg of bus. This is a simple solution when severe unbalance is found to exist because of long low-voltage runs with flat equal spacing

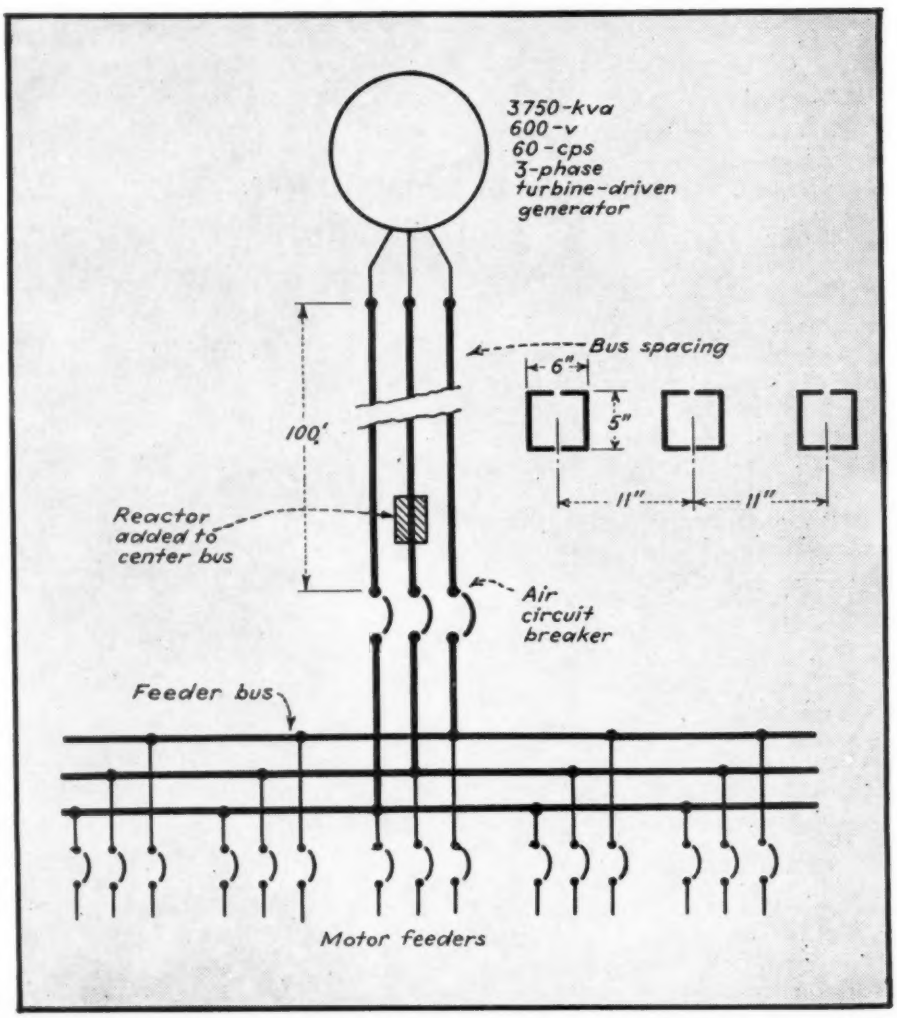


Fig. 3—This bus layout caused unbalanced phase currents in generator and system; increased generator heating until it limited the load to two thirds of the generator rating in one case. Middle leg was carrying 200 amp more than the outside leg

How Radiant Heating Maintains The Body in Healthful Comfort

Unlike systems that heat room air and let it warm the body, radiant heat allows for physiological reactions. It creates a sense of comfort by a balanced control of body heat loss*

By T NAPIER ADLAM
Vice-President
Sarco Co, Inc

▶ CONVENTIONAL HEATING aims simply to maintain room air at a predetermined temperature. Modern improvements add moisture to produce relative humidity that gives maximum comfort. Radiant heating, on the other hand, directs its principal effort to controlling heat loss from the body by maintaining room conditions compatible with physiological reactions and conducive to a feeling of comfort. Thus, the difference between the two methods is partly physical and partly physiological.

The body requires no heat whatever from without because it generates all it requires, together with a surplus that has to be thrown off. The opinion that warm, ambient air is needed to keep a person comfortable is fundamentally wrong; only essential factor in dealing with comfort and health is the surplus heat thrown off. This is the fundamental theory of radiant heating.

Roughly, the body gives off 400 to 420 Btu every hour, the quantity varying considerably with posture and occupation. Fig. 1, and according to environment. age and food. Fig. 2 shows how widely the amount varies with age. Both curves represent Btu per sq ft because the exposed surface of a child's body is much less than that of an adult's.

BODY HEAT LOSS

The 410 Btu given off by an average person can be divided as follows: Radiation and convection, 300 Btu per hr; evaporation, 62; respiration, 45; with a small amount excreted. Radiation occurs because the body is warmer than the surrounding walls, windows and ceiling. Convection loss takes place when ambient air circulates over the body's surface and carries heat away. Loss by evaporation occurs when perspiration evaporates from the skin, and the heat dissipated by respiration is given to the air we breathe. While it is difficult to differentiate between radiation and convection loss we find that if radiation is maintained at about 190 Btu per hr and convection loss at 110, a condition of greatest comfort and health is attained.

The sensation of hot and cold is avoided by raising the air temperature sufficiently high, or placing warm surfaces in walls, floor and ceiling, so the heat radiated is intense enough to compensate for a lower air temperature. While some conditions stimulate production of bodily heat, others merely dissipate the heat without in any way controlling its generation. Never overlook this in health and comfort considerations. Thus, a walk in cool air gives a warm glow and promotes appetite. But when warm air surrounds the body, heat crowds up on the surface, affects vital organs and reduces agility.

Everyone has experienced the invigorating effect of radiant heat when the body is exposed to the sun's rays on a cool day. Some of these come directly from the sun and include the whole range of ether waves, while others impinge on surrounding objects where they are increased in wave length and reflected to the body as low-temperature radiation. Should a cloud pass over the sun there is an instant sensation of cold, although the air temperature has not varied a fraction of a degree. This proves a thermometer recording air temperature is no indication of correct comfort conditions.

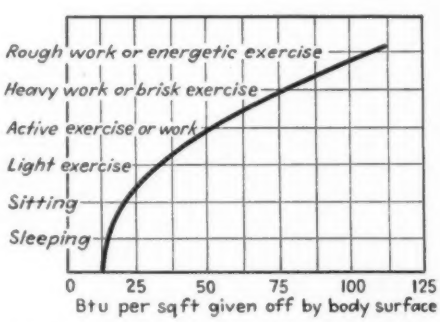


Fig. 1—Heat given off by the average person at varying rates of exercise

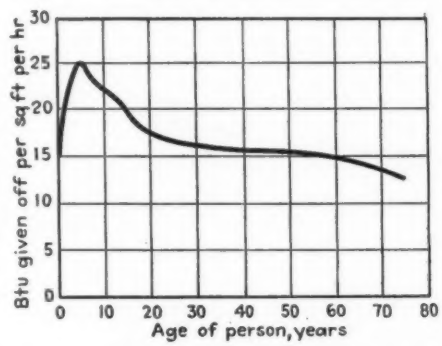


Fig. 2—Amount of bodily heat given off varies considerably with a person's age

HEAT-RAY CHARACTERISTICS

When exposed to sunlight, a body becomes warmer because its surface absorbs heat energy from the sun. Condition of the body surface plays an important part in relation to its temperature rise. For instance, a smooth white object does not become as hot as one with a dull, black surface. Another characteristic of heat rays is that they are reflected from a surface exactly the same as light rays. Thus, we can obtain a strong parallel stream of heat rays from a parabolic reflector when a hot element is placed at the focus. This enables us to reflect them from one direction to another, the same as a light beam with a mirror.

Radiant heat is a wave motion moving in a straight line through space at the speed of light—186,000 mi per sec. When the waves strike an object molecular vibrations are set up and some of the energy becomes ordinary heat.

A question often arises as to wave length of the rays in radiant heating. Length of ordinary visible light rays varies between 1/37,000 in. for the red to 1/65,000 in. for the violet end of the spectrum. Radiant heat is carried on at low temperature, varying between 90 and 160 F. These waves are situated very low in the infrared band and have a wave length of about 1/10,000 in. While radiant-heat rays travel in straight lines and

* Abstract of a paper presented at the Midwest Power Conference, Chicago, April 4, 1946

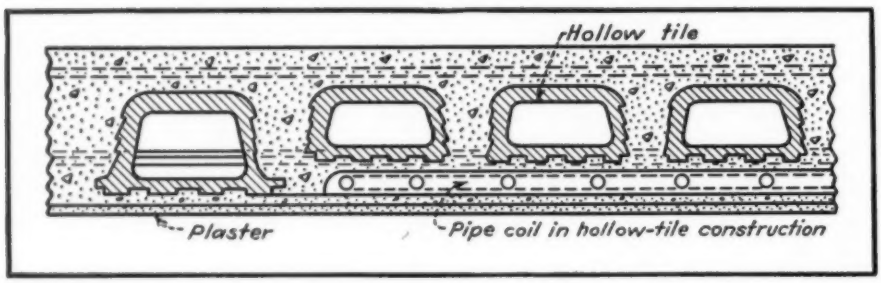


Fig. 3—Hollow-tile blocks built in the ceiling make a good nonconducting medium that prevents the heat passing upwards by conduction to the unheated space above

are unaffected by air currents, convected heat can travel only over the same course and at same rate as air which carries it.

Warm air alone gives the benefit of radiant rays indirectly; it gradually heats furniture and other objects in a room. But these objects must be colder than the air to receive heat from it, which usually makes the room's mean radiant temperature too low for comfort. To compensate for the extra body loss by radiation, higher ambient temperature is maintained to reduce loss by convection.

Mean radiant temperature (MRT) does not mean average surface temperature of walls, windows and ceilings, but *average amount of radiant heat emitted from these surfaces.* To determine what MRT shall be, it is necessary to know the body's mean surface temperature, kind of clothes worn, and area of exposed skin surface. In England this is established at 75 F, but here the author assumes 81 F gives results more nearly conforming to local conditions. Much depends on clothing.

RADIANT-HEAT SYSTEMS

Having considered the body's thermal mechanism and the conditions needed to meet its heat losses, let's look at the more practical side of radiant heating. The first system in England, designed by A H Barker, used thermal radiation from hot-water pipes embedded in plaster. Similar methods are still used; in general the heating surfaces are applied to walls, ceilings and floors. At present wrought iron, steel and copper pipes are used, and when embedded in plaster or concrete there is practically no difference in the Btu emitted per square foot of pipe. When used in plaster, wrought-iron coils are of ½- or ¾-in. pipe formed either into a continuous coil or grid. Pipes are usually spaced 4 to 6 in. apart, and individual coils may be fabricated into any convenient size, containing up to 200 ft of pipe. When placed in walls or ceiling, the pipe must be set back into the brickwork and covered with plaster not less than ½ to ¾-in. thick.

Vertical risers and other circuit pipes installed in recesses are fitted with specially constructed, hidden control valves so any coil can be regulated independently or isolated when desired. In large buildings having rooms with doubtful exposure losses and surface temperatures, these fittings provide an easy way to regulate hot-water flow permanently for individual coils and produce the required comfort conditions. They also provide correction for slight errors in calculating the heating surface required. Piping circuits form a complete hot-water circulating system, a basement centrifugal pump accelerating the water through the various circuits. Water temperature usually varies between 80 and 130 F, which gives average surface temperature of 70-110 F.

Fig. 3 shows pipe coils in hollow-block construction. Usual practice is to support coils in recesses and then apply plaster. Another method, Fig. 4, places steam or hot-water pipes in channels. Pipes are usually 2 in. dia of wrought iron, spaced 12 to 18 in. apart, with a slight gradient from entrance to return for easy air elimination.

Any desirable flooring material, either well-seasoned wood blocks or boards, may cover the concrete construction; in fact almost any material may be used provided it does not become plastic with heat. Large pipes do not contact the floor, except at points of support at each end because when buried in concrete, surface temperature is uneven with objectionable hot spots. Walls of some schools fold back so children breathe outdoor air; bodies are kept warm by increased metabolism and radiant heat from the floor.

Another method of providing thermal radiation uses flat cast-iron plates about ⅜ in. thick, one side of which carries steam or water passages. They come in various sizes and are constructed so they may be assembled with ordinary right- and left-hand-thread nipples, making it possible to build up units of any size. Units are laid flat against wall or ceiling, with molding placed around the edge to give the appearance of a flat raised panel. They can also be recessed so the panel is flush with the wall and the surface covered with veneer grained or painted to blend with other woodwork in the room. We have used these panels to take care of cold spots caused by open doors and windows in libraries where convector heaters could not effect a remedy. Instead of cast-iron units, panels can be fabricated from wrought iron, steel, or copper coils, spot-welded to sheet-metal face plates.

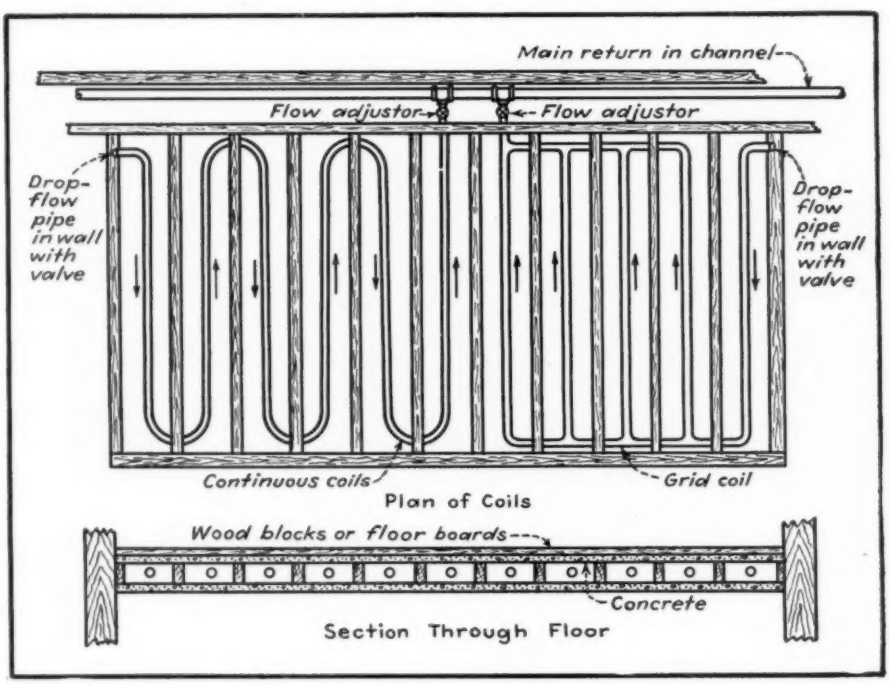


Fig. 4—The heating pipes, formed into a continuous coil or grid, can be placed in floor channels. A flow adjustor in each element return regulates the heat supply

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

BOILER PATCHES: Bolted, Riveted or Welded?

Discussing use and limitations of welding boiler patches, Harry M Spring completes his treatment of this maintenance device. Last month he examined bolted and riveted patches

▶ FOR A NUMBER OF YEARS Massachusetts has permitted welded patches, with two major if's. First, a welded patch must be in a stayed area such as the furnace sheet of an internally fired boiler. Second, no welded joint shall exceed 36 in. in length.

A welded patch in a stayed area requires, as does a riveted patch, a plate of the same material and tensile strength as the plate cutout. Its installation follows this procedure: Set the patch in flush with the boiler shell. Bevel the edges of both the patch plate and the cutout to a 30- to 45-deg angle. Drill and tap staybolt holes. Weld in the patch, preferably by electric arc-welding method. Then install staybolts.

If a patch has to cross a riveted joint in the furnace this requisite should be met. Namely, an offset should follow the lap of the plate.

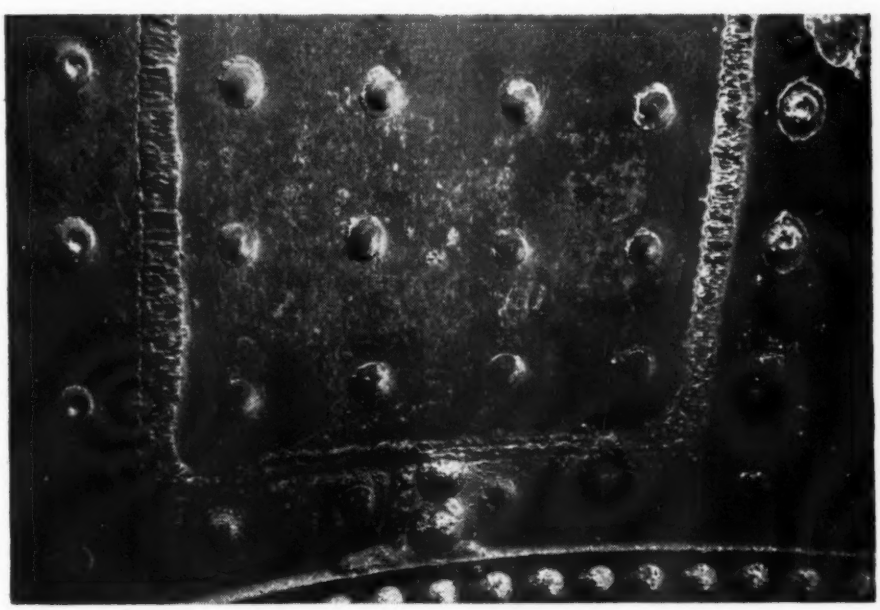
Rules for welded-patch installations in other states differ from those of Massachusetts. The ASME Code and the recommendations of the National Board of Boiler and Pressure Vessel Inspectors form the basis for a set of guiding rules, for use with welding. These rules, more lenient than those in practice in Massachusetts, were recently published by the National Board.

As an example, in some localities there is a tendency to permit welding cracks in an unstayed plate provided (1) plate thickness is not over one inch (2) the crack itself does not exceed more than a distance equal to 16 times the plate thickness and in no case more than 8 in. (3) the crack itself does not come within 2 in. of a longitudinal riveted seam.

The writer feels that this repair of a crack in an unstayed area should be questioned at the outset. Development of such a crack in a solid plate is not normal. Unless its cause is readily apparent it suggests some basic failing such as faulty design or a defective plate that may lead to further cracking.

On-the-Job Welding. A question is raised in this writer's mind on the soundness of another repair; that is, installation of flush-welded patches, which are permitted in some localities. An uneasy feeling persists that despite a welder's qualifications no flush-welded patch, installed in the field and not given a uniform stress relief and a radiographic examination, can be fully trusted. Too much depends upon the personal workmanship of the welder. Failure of such a patch in a high-pressure boiler could lead to a serious accident. All boiler-patch repairs should follow impersonal, mechanically sound procedures based on proved tests.

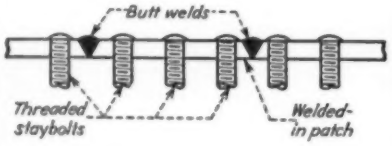
One well-designed patch for welding is the inside and overlapping one shown at top of page 104. Should a weld fail, this design assures that only a leak can develop since the patch itself cannot blow out.



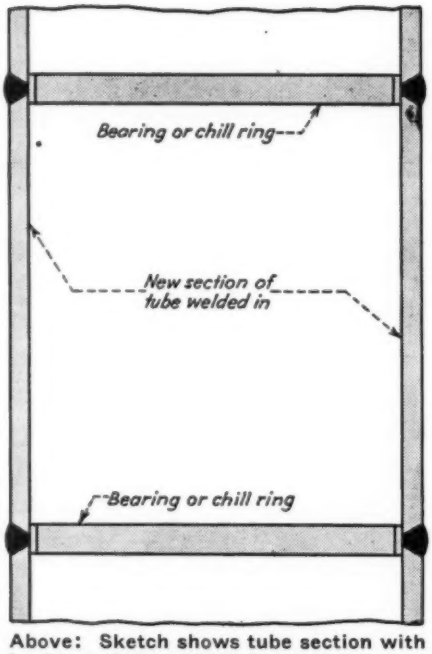
This welded boiler patch illustrates the rule that in all cases where a patch crosses a joint it should have an offset to follow the lap of the plate for complete safety

WELDING OF TUBES

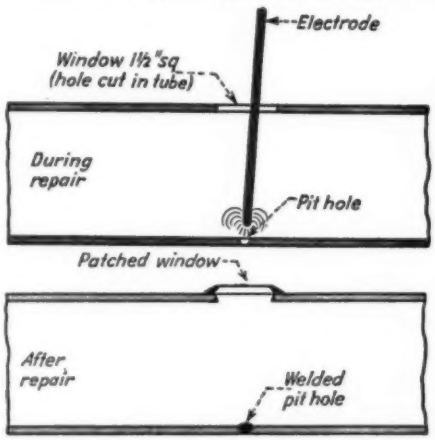
Welding lends itself, however, to repair of boiler tubes. Patches in this instance should never be used. Tubes,

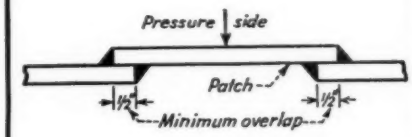


Welded patch, stayed area. Patch of same material with drilled, tapped staybolt holes set flush



Above: Sketch shows tube section with backing rings welded in place of a removed defective area. Below: "Window" welding involves cutting and later on patching a hole in accessible side of a tube to repair inaccessible section





This inside, overlapping patch is well designed. Weld failure results in leakage, not blowout

on which patching has been tried, last only a few hours. After that, the localized overheating caused by double thickness of metal provides bulging and finally failure.

If a new tube is not available and repairs are necessary, follow one or the other of these procedures for welding: (1) Cut out the defective section of the tube and weld in a short length employing backing rings. (2) Build up the defective section by overlapping beads of electric-weld metal applied in a girthwise direction.

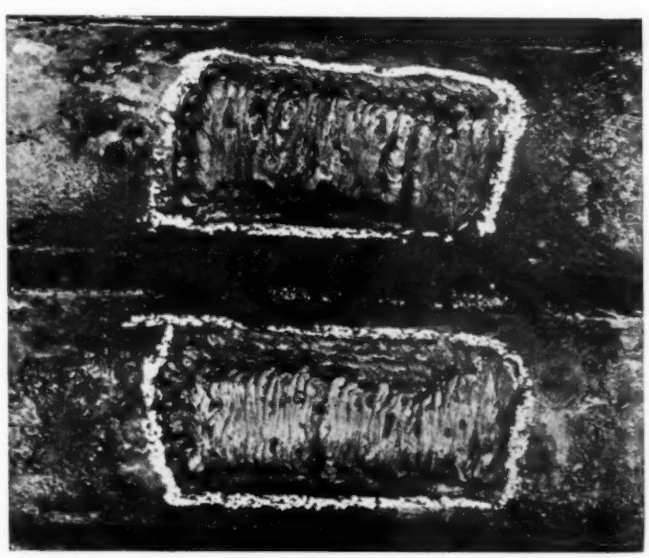
Emergency Welding. Welding has still another feature that makes it a desirable boiler-maintenance tool, that is, its flexibility. Oftentimes emergencies develop that require unorthodox repair measures, some of which may prove contrary to all rules and regulations. One that comes to mind is that called "window" welding. It meets those cases where the underside of a tube in a top row, for instance, is pitted through and the defective area is not accessible. Local conditions do not permit plugging tube ends.

To meet such a problem, the welder used a cutting torch and carefully cut out a "window"—a piece of tube about 1½ in. square on the top side directly over the defective area. Through this window he inserted a ⅛-in. electrode and by electric arc-welding welded over the pit hole from the inside. He then fitted the cutout piece back into the window and welded it pressuretight.

This repair does not exactly comply with all existing rules, and certain State Codes would hesitate to approve it. From an operating standpoint, however, one might say that no other means exist for making a temporary repair, which is both entirely safe and practicable and which allows the boiler to stay on.

This essential requirement, that a piece of equipment should be kept on the line as long as practicable, should underlie both choice and application of all patches. Experience has developed the various limitations and advantages of the three general classes of patches discussed in this 2-part article.

For standard patches of any description on a permanent repair remember that no such major work should be undertaken without approval of an authorized boiler inspector. In many states this is a legal requirement, and in all it is a prime safety-first requisite.



Above: Attempt to repair boiler tube with a patch. Overheating of double layer of metal on boiler-tube patch produced this bulge and failure. Right: Two views of repairing defective-tube area with procedure that builds up the area by welding overlapping beads in a girthwise manner

A Blacksmith Tackles MASS PRODUCTION

In humorous vein H B McDermid recounts an able blacksmith's ingenuity on a power-plant construction job. Louie triumphs over a doubting foreman by turning out satisfactory items at a low cost with rather crude and certainly inexpensive tools

▶ON A LARGE CENTRAL-STATION power-plant construction job, the blacksmith was an Italian, Louie by name. Keen, resourceful and loyal, he came by his trade training honestly, if perhaps somewhat unconsciously, from his father, grandfather and four older brothers, all blacksmiths. If he chose, and he did during construction "lulls," he could handle a "fire" in the country's greatest locomotive shops. But his preference was to be blacksmith on construction jobs. To this trade he brought intimate knowledge developed from early environment and long experience, and from mass-production methods picked up in locomotive shops.

Louie's boss, Ed, the master mechanic, was a real master of men, fair and just, largely self-taught, with innate ability that brought him honest respect. In fact Ed enjoyed a reputation for coming up with a workable solution that held no matter what the problem. He and Louie had been together on many a job; Ed explained it this way, "I don't know how he keeps in touch, but every time I get a job, no matter where, in ten days or so, here comes a letter from Louie, asking for his blacksmith's job again, and I always give it to him."

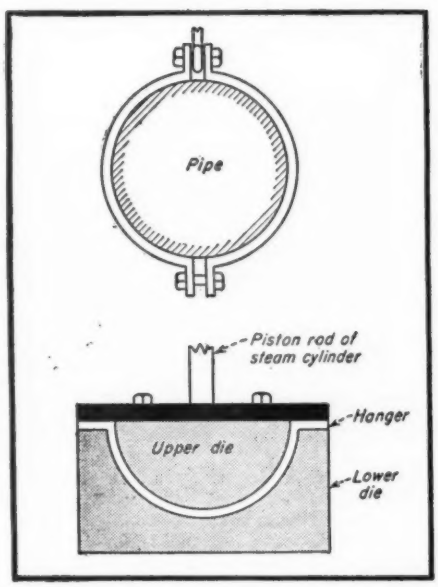
NOT ENOUGH BLACKSMITHS

So much for the men, and now the job. The contractor company chose its foremen from those available, mostly strangers. These foremen, shaking down into their jobs, inspected the setup laid out by the superintendent and master mechanic, with particular attention to the construction shops. One newly hired foreman, a surly pipefitter, remarked, "It's easy to see that this master mechanic won't last long. On my last job of about this size we had 30 blacksmiths and he's trying to do this job with one!"

Louie, the lone blacksmith, inwardly boiled at this attack on his best friend. He was so moved that he went to Ed, and excitedly commanded his boss, "You do what I say, and we fix him!"

The contractor's policy called for on-the-job fabrication of all sorts of parts and fixtures that experience had proved possible and profitable, such as hundreds of pipehangers in all usual sizes. These hangers were of two pieces of common strap-iron, made to clamp-bolt on pipes, and to Louie's sharp eyes they lent themselves to mass-production methods. Moreover these straps were, of course, right up the caustic pipefitter-foreman's alley.

Acting on Louie's suggestions for making the hangers, Ed obtained the superintendent's permission and set out for town and used equipment dealers. Here he picked up a steam-driven rock drill, with a 6x30-in. cylinder, that became, after some adaptation, a steam hammer of sorts with a framework of odd steel pieces. Next step in Louie's plan called for forms or dies to forge the hangers to the required sizes.



Upper sketch shows fitted pipe hanger and lower the die form that Louie used

Louie and Ed made up dies like those of a drop forger, but of very simple design. The semicircular form, built to shape the inside of the half hanger, had the same radius as the outside of the pipe for which it was intended, with due allowance for thickness of the stock. This form was firmly attached to the piston rod of the homemade steam hammer; lower form for the outside of the half hanger was similarly attached to the anvil. In operation, a heated blank was laid across the lower die and a light tap struck to bend it slightly so it held its place . . . then, bam! the forging was finished.

LOUIE'S DAY

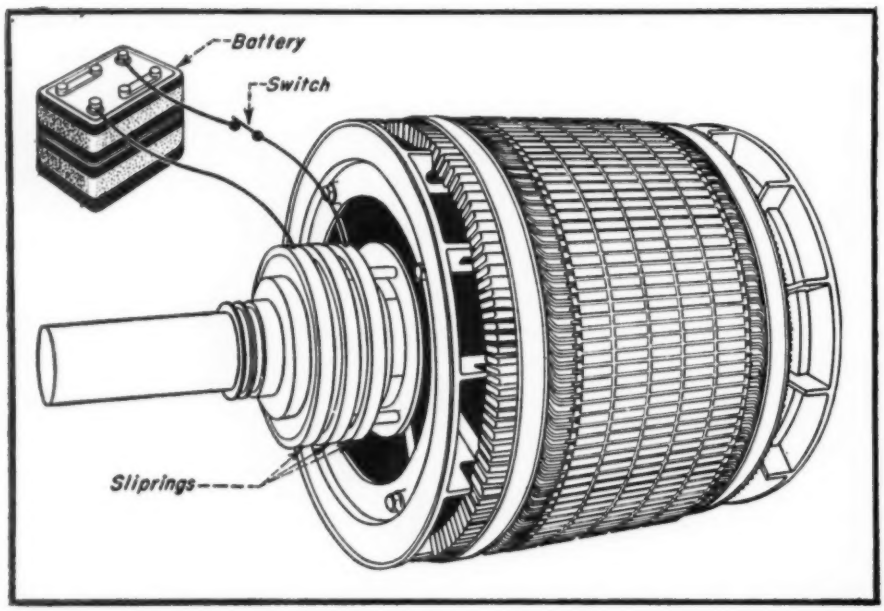
One day the inevitable happened. The pipefitter foreman came to Louie with a rush order for thirty 8-in. hangers. He no sooner left than Louie busied himself (1) cutting ½x2-in. stock with his power shear (2) building a long fire and (3) setting up his homemade set of dies. Louie pushed his stock through the forge fire and dies, and in short order had completed and filed in orderly ranks the requested 30 hangers.

About an hour after placing the above request the pipefitter foreman came back on another errand to the shop foreman. Louie yelled at him, "Hey you, I wish you'd get these . . . irons out of my way!" The shop foreman, telling the story later, said, "You could have knocked that pipefitter foreman's eyes off his face with a baseball bat, he was that surprised." The job ran on well over a year but never once did that foreman talk of a need for more blacksmiths.

This experience proves that an ingenious man, well grounded in his trade, can sometimes initiate mass-production methods to turn out satisfactory items at low-unit cost with rather crude and certainly inexpensive tools.

Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids to Operation



TESTS FAULTY WINDING CONNECTIONS

LOOSE CONNECTIONS in the rotor windings of a slipring motor may be quite difficult to locate. Sometimes temperature differences in some connections indicate where the faulty ones are. The poor connections always have the highest temperature. A test can be made by starting the motor, operating it under load for a short time, and then shutting it down. Feel the windings' end connections with the hand. The defective ones should have the highest temperature. There are two objections to this method: (1) The temperature may equalize in the connections before they can all be tested with the hand. (2) The hand is not very sensitive to small temperature differences.

I have also obtained satisfactory results using a 6-v storage battery to make the test. I connect the battery to two sliprings, as in the figure. Clamp the battery leads to the sliprings and put a single-pole switch in one of them to control the circuit readily. When ready to make the test close the switch and feel the windings' end connections for ones that have an excessive temperature.

With this connection only two branches of the Y-connected winding is in circuit. When the test has been completed on these branches shift one battery lead to the third ring and repeat the test. If you have time it is best to wait until the windings have cooled before making the second test.

Cleveland, O. M H STUTSMAN

Forced Draft Adds to Boiler-Room Comfort

WHEN ALTERATIONS were made in a boiler plant several conditions prevented installation of air heaters. This plant had four operating levels; basement, firing floor, drum level, and economizer floor. Induced-draft fans, on the latter floor, gave trouble because of heat, dust and fumes. Besides, the location was always an unpleasant one in which to work.

To improve these conditions we ran a large air duct from the economizer floor of each boiler down to the intake of its forced-draft fan on the firing floor. Intake of each duct was flared so it would draw air along the economizer walls. We closed the ventilators in the roof and walls and the door leading to the conveyor platform above the coal bunkers. As a result air in the boiler plant was much cleaner and working conditions on the economizer floor greatly improved. Induced-draft fan motors gave less trouble and the increase in combustion-air temperature added something to boiler and furnace efficiency.

Lancaster, England W M GORE

Demountable Forms Speed Foundation Work

ONE COMPANY had several ground level concrete foundations to construct for

pumps and engines. This job was greatly simplified by building a demountable form, as in the photo. This form can be easily set up for pouring the concrete, and quickly removed for another foundation after the concrete has set.

The form is made of 2-in. planks tied together with 1-in. angle iron and assembled with the aid of long tiebolts. When the excavation is completed short pipes are placed across its opening and the form assembled on them. The trapezoidal-shaped end pieces fit into grooves cut near the ends of the longer side sections. After the form has been assembled

and the tie-bolts tightened it is lifted by two men, the pipe supports are removed, and the assembly is lowered into the excavation.

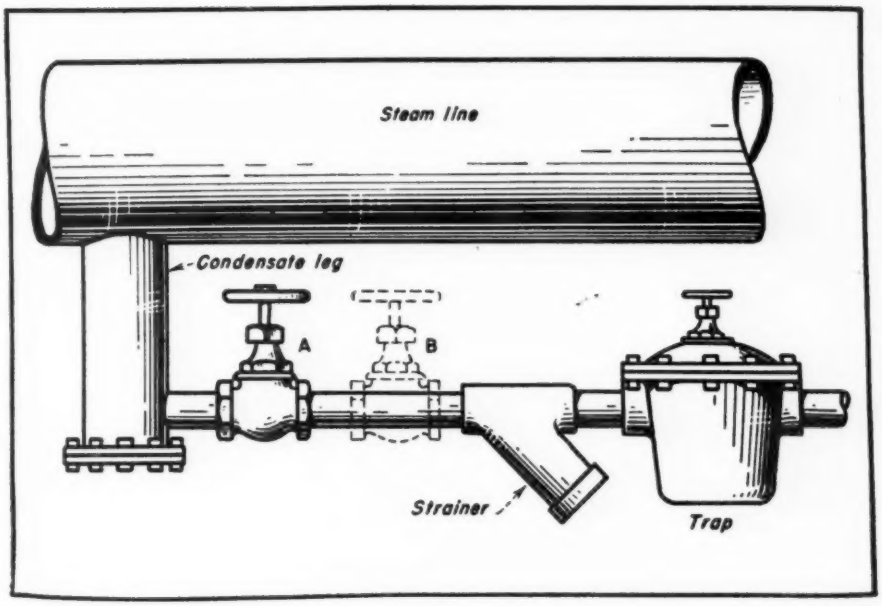
To assist in accurately locating the holding-down bolts in the wet concrete, steel strips *S* are fastened to the top of the form. From accurately located marks on the strips and on strips that go across the form, the foundation bolts can be easily located in their correct positions to receive the machine.

Pomona, Calif. G M WILSON

Used an Old Valve for Throttling Condensate

IN OUR PLANT we sometimes have to remove for overhaul a high-pressure drip trap from a main steam line. When the trap is not piped with a bypass valve we bleed the condensate to atmosphere. This is done by closing the stop valve *A* in the line to the trap and removing the latter. Throttling the condensate with valve *A* was not satisfactory because wire drawing cut the valve disk and seat so it required replacing.

To eliminate this difficulty we have ready an old valve that is cut and worn



or leaking. We install it beyond the main valve as shown by dotted lines at *B*. We close this valve and completely open valve *A*, then throttle the condensate as required by valve *B*. This prevents damage to stop valve *A*. It can be closed tightly and *B* removed when the trap is ready to return to service.

This method is practically the same as that used on drains of high-pressure air bottles and on most boiler blowdowns. Installation of bypass piping with a suitable hard-trim throttling globe valve, when available, is the real solution.

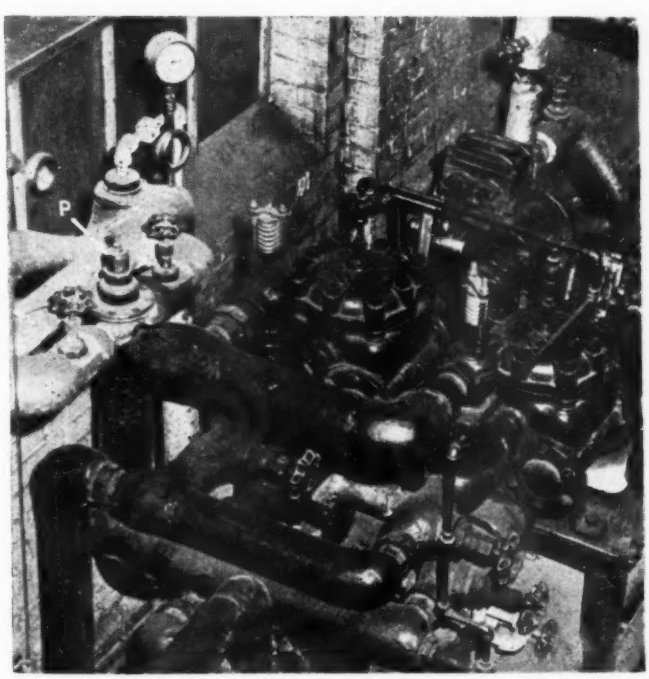
DEAN H BERGMAN

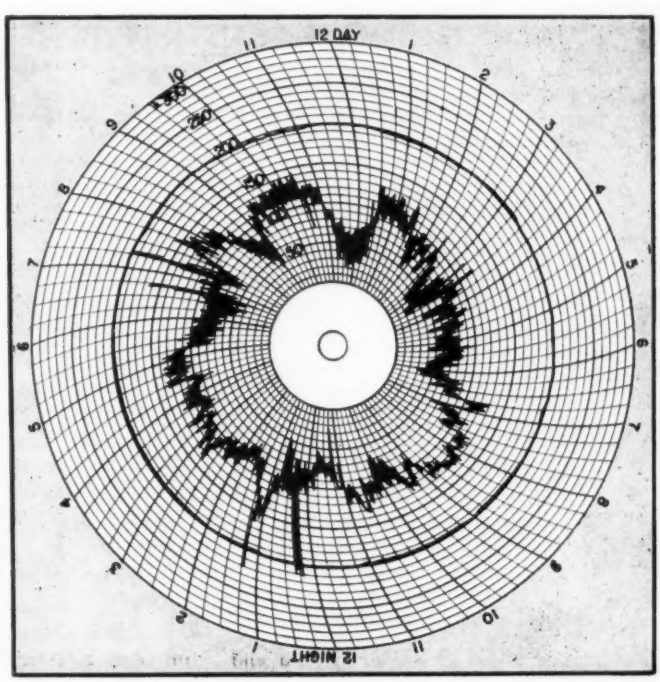
Bellingham, Wash.

PRESSURE REGULATION HOLDS CONSTANT FUEL-OIL TEMPERATURE

AFTER INSTALLING our new oil-burning boilers we had trouble maintaining constant fuel oil temperature. The oil is heated with steam. As originally installed the temperature control consisted of a thermostat connected to the oil system that regulated the steam flow to the heaters. Oil temperature under this control system fluctuated noticeably with load variations and was unsatisfactory.

I decided after some thought that if constant steam pressure were maintained in the heaters at all times, a more constant oil temperature might result. I therefore removed the thermostatic valve



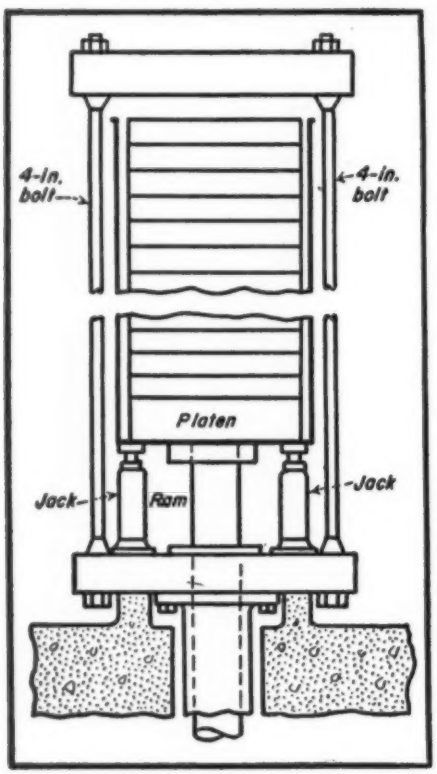


from the steam-supply source and replaced it with a pressure-regulating type, P in the photo. The valve was adjusted to maintain about 40-psi steam pressure in the heater. The daily oil-flow temperature chart shows the results of heating the oil by this pressure-control system. Note that oil temperature remains constant at about 200 F, and varies slightly with different variations in load.

Worcester, Mass. C J LLOYD

Heating Makes Bolts Permanently Tight

THE MAIN FRAME BOLTS of some tire presses worked loose in spite of the mechanics' best efforts to set them permanently tight. Bottom nut on each of these 4-in. bolts was practically inaccessible to the wrench used to tighten it. After some study of how the nut might be made permanently tight we decided that heating the bolt ends before putting on their nuts was the most feasible plan.

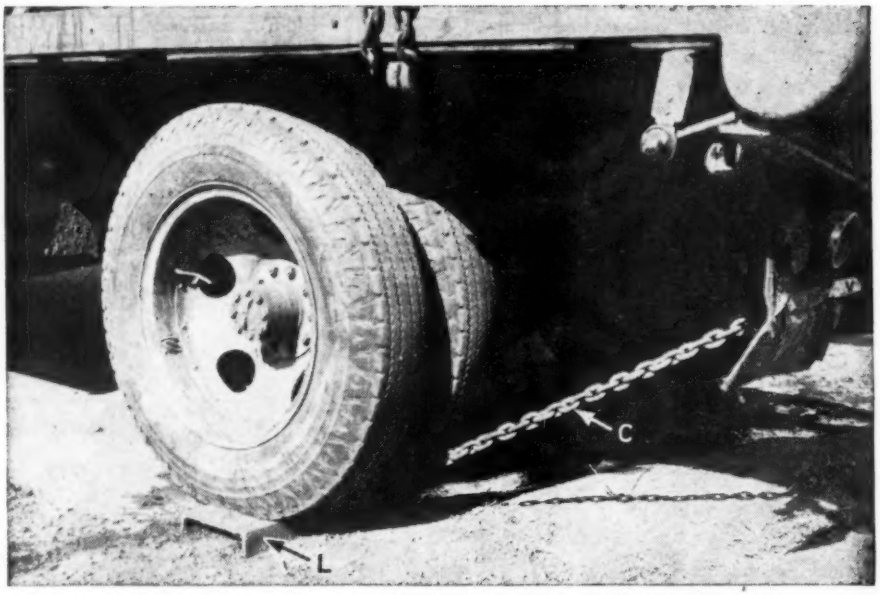


We brought the ram up sufficiently high to set a hydraulic jack under each corner of the platen, as in the diagram. We then removed the nuts from the bottom ends of the four bolts and with the hydraulic jacks lifted the top frame and bolts far enough to clear the bottom frame. The weight of one bolt at a time was taken on a chain hoist and the nut removed from its top end.

We heated this bolt's bottom end and its nut to a temperature of about 250 F, and lowered the bolt into its hole and screwed up the nut handtight. After all bolts had been treated this way the top frame was lowered in place, and the bolts and these nuts tightened with wrenches. When it was found that the lower nuts remained tight after heating the bolts, all other presses in the plant were treated accordingly.

It was necessary to heat the nuts to get them on their bolts. Expansion of the 4-in. bolt's diameter was sufficient to prevent a cold nut from running on it freely. Heating a bolt required considerable care to prevent its temperature getting too high. Experience shows that contraction of steel from a temperature of about 212 F is sufficient to produce a tight fit without overstressing the metal. We use our judgment in having the bolts at this temperature by the time the nuts are tightened.

Cincinnati, Ohio H B MCDERMID



CHAIN ANCHORS SPEED WINCH OPERATION

MOST SERVICE TRUCKS have sufficient power at their winches to handle almost any load but the time-consuming job is to anchor the truck so it does not skid backward even when the brakes lock the wheels. The photo shows how one engineer solved this problem on his winch-equipped truck that moves heavy parts about the plant and yard.

On each side of the truck a length of heavy chain *C* is fastened to an 18-in. section of light channel-iron *L*. The other ends of the chains are bolted to the truck frame, at a point in line with truck wheels' center line. The chains are just long enough when taut to permit the wheels to rest on the channel-irons as shown. Regardless of whether the truck is on pavement or ground the channel-irons prevent it from being hauled backward while the winch pulls a heavy load.

While the truck is traveling about, the channel-irons and chains are hung on short steel hooks welded to the upper portion of the frame a few inches back of the spring shackles. While one anchor-iron usually is sufficient to hold the truck in position, two are carried with the truck, one on each side, so even the heaviest jobs can be handled. These anchor plates easily pay for themselves in time saved on a single job.

Pomona, Calif. G M WILSON

Care of Hot-Water-Supply Boilers and Storage Tanks

IMPROPER INSTALLATION or care of a hot-water-supply system may lead to trouble. These pointers aid in preventing accidents and increase the equipment's life.

1. Provide safety-valve protection against excessive pressure, especially if a check valve is installed in the water-supply line. The safety valve should have a hand testing lever and be set at not over maximum pressure for which either the boiler or tank is suitable.

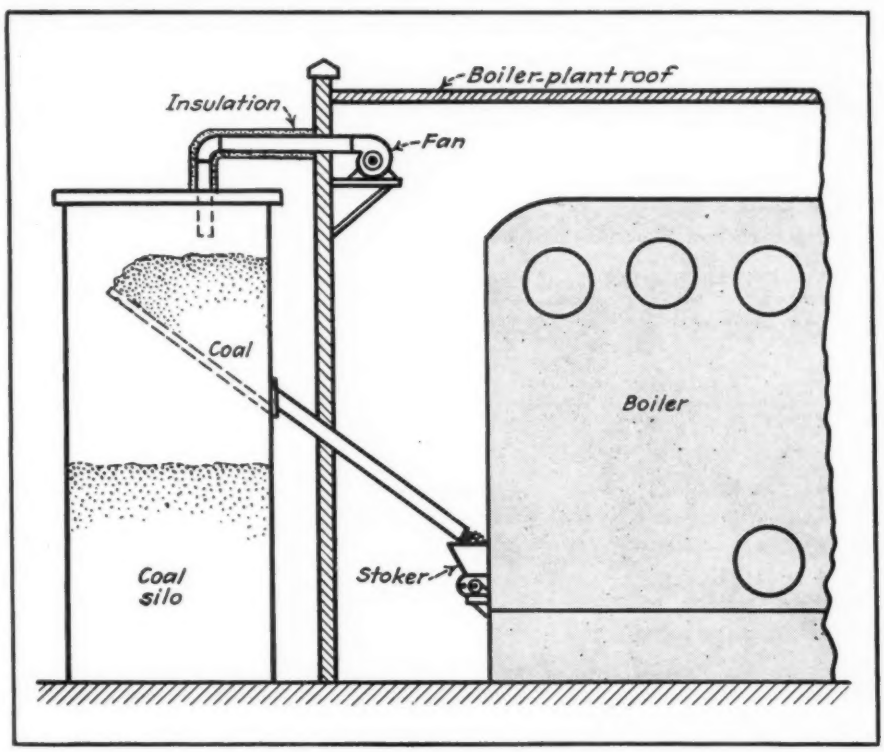
Supplementary to or in combination with the safety valve provide a temperature-relief valve. Protect light-gage tanks against collapse with a vacuum-breaker valve. Always supplement these requirements, if necessary, to meet any local ordinances.

2. Don't install a boiler too large for the tank. Excessive water temperatures together with frequent operation of the temperature-relief valve may result.

3. It is good practice to install a blowdown (drain) valve on each side of the boiler and open these valves for a few moments, at least once a week, during operation. Drain the system and flush out all sediment through access openings or pipe connections once a year. At this time remove handhole or manhole plates, and clean and inspect internal surfaces.

4. It is usually advisable to consider installation of tanks made of corrosion-resistant material, especially in locations where the water is corrosive. A tank made according to the standards of the ASME *Code for Unfired Pressure Vessels* is recommended. In addition, state or city requirements may have to be complied with.

Canton, Mass. HARRY M. SPRING



FAN ELIMINATES FROZEN-COAL TROUBLE

THE DIAGRAM shows a method we use to prevent coal freezing in an outdoor silo. Coal flows by gravity down a 45-deg chute to the stoker hopper. In winter we had considerable trouble with coal freezing and clogging the chute's entrance.

To eliminate this trouble we installed a small fan under the boiler-room roof and piped its discharge through the wall into the silo's top, as shown. We insulated the outdoors section of air pipe to prevent heat loss and keep the air temperature as high as possible going into the silo.

The air blown into the silo kept the temperature sufficiently high to prevent the coal freezing. Before the fan was installed it was frequently necessary in subzero weather for a man to go up on top of the silo and break the coal loose with an iron bar. The fan eliminated this disagreeable work.

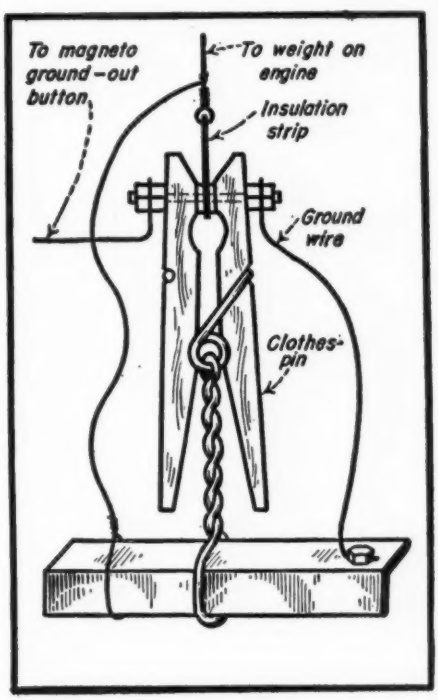
P M VAN WINGEN
Grand Rapids, Mich.

Rough-and-Ready But Effective Engine Governor

ON MANY RECIPROCATING oil-field pumps driven by gas or gasoline engines, governors are not provided. If for any reason the engine becomes unloaded it races and the unit may be damaged if an attendant is not at hand. On such a unit it is common practice to connect a line to the magneto cutout switch, carry the line through a pulley to a weight placed on the engine. Should the engine race, the resulting vibration causes the weight to fall off and open the cutout switch, stopping the engine.

While this inexpensive method of protecting internal-combustion engines against overspeeding is not uncommon the cutout switch designed by one plant foreman is unique in its simplicity and positive action. He made this switch from an ordinary spring clothespin, as in the diagram. He drilled a small hole through the nose of each half and inserted metal contacts that close on a strip of insulation to hold them apart.

After mounting the assembly at a convenient location on the equipment's steel framework, he connected one contact to the engine magneto's groundout button. The other contact he connected to ground, while the insulation strip was connected by a suitable line run to a weight on the engine. If the engine races the weight falls off, pulls out the piece of bakelite,



to let the contact close and ground out the magneto. To prevent the insulation strip being pulled too far the line's loose end is connected to the steel frame.

While these methods may appear unorthodox to some engineers they have prevented many engines from being wrecked and relieved the operators of much worry. These suggestions are also helpful for any engineer to have in his bag of tricks for ready use.

Los Angeles, Calif. C R PARKER

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

ELB Wants Pointers on a Better Hot-Water System

WE HAVE TROUBLE maintaining hot water upstairs in our hotel about an hour after the demand starts in the morning. Our heating and circulating system is shown in sketch Q-1, on the facing page. The heater seems to have enough capacity but the hot water doesn't circulate fast enough to keep an adequate supply upstairs.

I plan to add a pump to the circulating system as shown in sketch Q-1. Will POWER readers tell me whether the pump as added will solve the problem? Should I make some changes in the present piping arrangement?

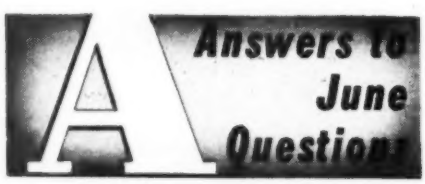
Would my system work better if the cold water entered the heater instead of entering the storage tank as shown. At present the cold water enters the storage tank with the return. Does this tend to dilute the hot water? If this is true, why does the system give water that is too hot for the first hour and fail during the rest of the day?—*ELB*

How Can I Avoid Spontaneous Combustion?

IN THE CENTRAL HEATING PLANT of our academy, where we burn lignite coal, we are now planning to enlarge the storage capacity. So far we have had no trouble with spontaneous combustion, but I am wondering if POWER readers have solved the problem of keeping lignite coal from catching fire while it is in storage.

Some of the plants near here have experienced this trouble, and it is a lot of hard work removing several carloads of coal and spreading it outdoors to put out the fire.

I would like to know how to handle the coal and how big to make the new bins. If any readers have found that special designs or shapes have been especially successful, will they describe them and also give me some rough sketches or photographs?—*LDK*



How Can Waste Heat Be Reclaimed?

(This is Question 1 from the June issue, with best answers from readers.)

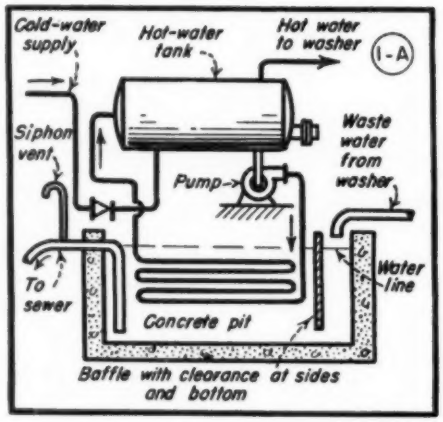
In our laundry, waste water from the washers at about 120 F discharges directly to the sewer. I believe we could heat incoming water 10 or 20 F by extracting heat from this waste water if we had a suitable heat exchanger. Because incoming water flow is intermittent in relation to waste discharge I would like to know what kind of heat exchanger will produce the best results.

I have been considering building a concrete pit with overflow to the sewer to hold the waste water. Installed in the pit will be several layers of pipe connected into grids through which the fresh water will flow. What is the best way to design and connect the related parts? Will this arrangement work as well or better than a shell-and-tube heater? How can the waste-water piping be arranged to prevent cold-rinse water from the washer being dumped into the heat reclaimer pit?—MRM

Baffles in Pit Help Separate Water

MRM CAN RECLAIM some waste heat, as he proposes, with a concrete pit and coils. Coils should be in upper part of tank to be in contact with the hottest water. Waste water should dump behind a baffle board, at end of tank.

When hot water is dumped it flows around the baffle and remains in upper part of tank. When cold rinse water is dumped, it settles to the bottom and works toward outlet end. Overflow pipe should extend nearly to bottom of tank, sketch 1-*A*. This always causes coldest water to be displaced whenever more water flows into the tank.



Cold-fresh-water coils can be arranged as in the sketch. While a pump and motor involve extra expense, the constant flow of water through the coils increases heat transfer. This arrangement permits heat recovery even though there is a temporary lull in hot-water demand.

Scum may form on outside of coils and provision should be made for cleaning. Use of shell-and-tube heater might recover a slightly greater percentage of heat but would require additional piping and valves.

Bellingham, Wash. D H BERGMAN

Pass Only Hot Water Into Pit Reclaimer

THE OUTLINE does not give enough data for a specific solution. However, if *MRM* determines the amount of hot water available from the washers, the time when it flows and the amount, and the temperature and time his incoming water flows he will have the data for computing size of his heat exchanger.

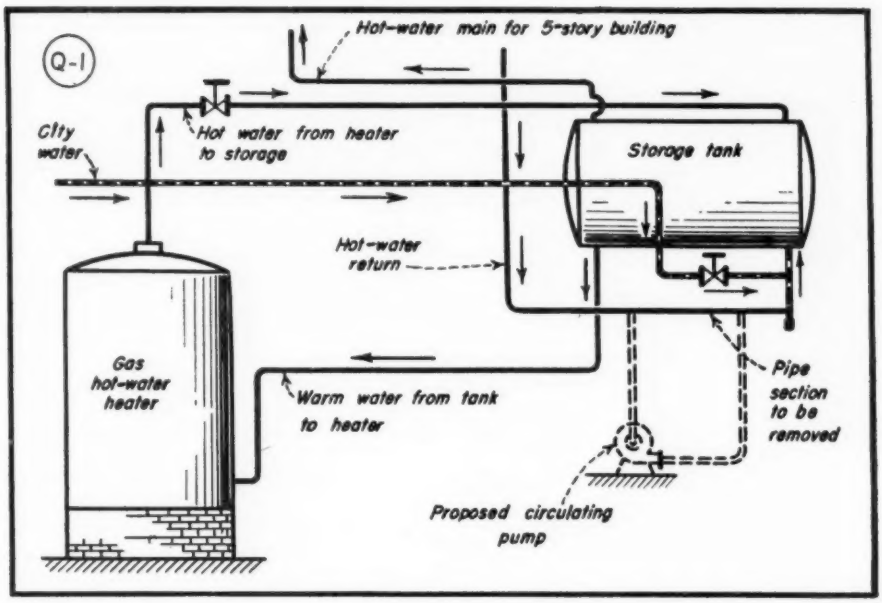
After working out the heat-exchanger size, the installed cost of various types should be compared, also their operation and maintenance cost.

The concrete pit for the wash water should be arranged so the fresh-water pipes leave the pit near where wash water comes in, thus resulting in a counterflow installation.

A shell-and-tube heat exchanger is more efficient as a heat-recovery unit but will probably cost more than a concrete pit if the amount of water involved is large. This can only be determined by getting actual bids.

The fresh-water piping should be a welded job inside the pit and may be steel or copper. Copper piping may be installed with sweat fittings or brazing. A splitter box can be built in the floor drain at the washer and operated so the cold rinse water from the washer is bypassed around the heat exchanger.

Piney River, Va. I A BUTCHER



Well-Designed Pit Offers Good Efficiency

CONVENTIONAL METHOD of reclaiming heat from laundry waste dumps is to install a pit-type heat reclaimer, made for this purpose. A shell-and-tube reclaimer is usually installed where there is not enough room for the pit. The pit is preferred; because it takes up no room when the top is covered, it can be used for floor space.

The pit reclaimer consists of two headers, connected by long, thin-walled tubes of small diameter. The city-water main is connected to one header and the other to the hot-water storage heater. The pit is kept full of hot waste water and the heat is extracted by the cold water passing through the tubes. Size of reclaimer is governed by amount of hot waste water available.

Amount of heat that can be extracted by the reclaimer is governed by (a) amount of tube surface in reclaimer and (b) the rate of flow through the tubes. The exact size and shape of the reclaimer cannot be determined from the data given. It should be large enough to accomodate both the waste and fresh water flow without interfering with operations.

Cold waste water has to go along with hot waste water, as it is difficult to separate them. Water in the reclaimer pit is hot most of the time.

For best efficiency the reclaimer, regardless of its type, should be designed by engineers familiar with this work. It should be installed properly to make best use of conditions. To cut installation costs and be efficient, it should be installed as close to hot-water storage as possible and the lines covered by good insulation from reclaimer to heater. It requires frequent cleaning as the rinse water leaves deposits on the tubes that decrease its efficiency if not removed regularly.

Baltimore, Md. C W PARKS

Use Trench That Is Easy to Clean

USE OF A PIT to contain coils in *MRM's* heat reclaimer brings up the problem of sediment, dirt, lint, etc. They will all accumulate in the bottom and build up rapidly as overflow is at the top. Resultant pit cleaning would involve removing all coils, or making the pit large enough to get around them to get at the sediment.

MRM should consider a long, rectangular box or pit of relatively shallow depth. He could have a drain fitting in the bottom and one end for flushing accumulations to the sewer at intervals. He could run hot waste in one end and out over the other.

He should make up an endless coil for the heater, with probably about three tiers of coils. Run cold water in through bottom section, then through middle and higher section, finally through top third section next to hottest waste water. This type heater would give volume for the water being heated, and also allow for sediment-accumulation cleaning, which is important here. To eliminate cold rinse water, he should make a change-over control right at the washer for hand setting, as an operator is probably on hand.

Shiprock, N. M. J F MAHER

Heat Reclaimer Not Practicable

IT IS QUITE POSSIBLE to reclaim some waste heat from laundry water. However, results would hardly warrant time and materials necessary. Most laundries do not attempt to utilize waste heat.

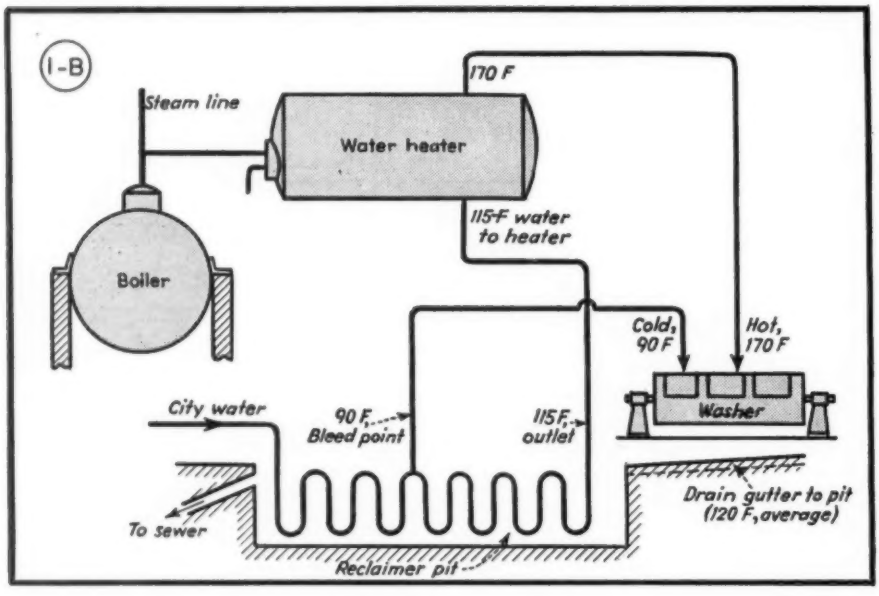
If *MRM* decides to go ahead, he must consider the following: (1) Outside of incoming water pipe has to be cleaned quite often as waste water (and all dirt, etc it contains) soon deposits a film that interferes with heat transfer. (2) This also means that the operator of the washing machines has to operate a 3-way valve: from washer to sewer (for cold waste water), and from washer to heat exchanger (for warm waste water). Proper operation of this valve, and of entire heat-recovery system, may well be overlooked several times due to negligence of the operators on the washers.

Brooklyn, N. Y. A J WENIG

Bleeder Heat Exchanger Is More Efficient

IF MRM DOES NOT HAVE a heat reclaimer he should by all means investigate its possibilities. Recovery of heat from waste water saves enough fuel to pay for equipment involved in a short time, and in addition releases sufficient boiler and water-heater capacity to permit a larger volume of business.

Most effective heat reclaimer is the bleeder type, connections to which are shown in sketch 1-*B*. All water to wash room passes through the first section, a portion of which is bled off at about 90 F. Remainder passes through the second



section and can be raised to 105 or 115 F depending on season and city-water temperature. The cold water is heated to 90 F for the sole purpose of increasing waste-water temperature. This regenerative principle makes possible an outlet temperature of 115 F.

Most popular type of reclaimer has copper or Admiralty metal tubes for clear water, immersed in a concrete pit through which waste water flows in the reverse direction. Baffles are installed in the pit to promote proper flow distribution. Although some additional gain results from bypassing cold rinse water around the pit, this practice is almost never followed because of practical difficulties.

If floor space for a pit is limited, a shell-and-tube heat exchanger with forced flow can be used. Because of higher rate of heat transfer with increased water velocities such a reclaimer can be much smaller.

Design of a heat reclaimer is so involved that details of tube size and spacing are better left to the manufacturer. Nearly all factors are a compromise. Therefore a careful survey of local conditions assures best results.

Baltimore, Md. C H WHITBY

Heat Reclaimer Is Worth the Money

SEVERAL FACTORS MAKE a heat reclaimer an attractive investment. (1) Fuel reduction is a definite saving. (2) Addition of a reclaimer also relieves an overloaded boiler, or permits expansion without purchase of a larger one. If the washroom suffers because of insufficient hot water, a reclaimer improves conditions and probably saves cost of a larger heater. A heat reclaimer saves from 25 to 40% of the fuel where all waste water goes to the sewer.

Two general classes of reclaimers are (1) the single section, where cold water passes through, is partially heated, then goes on to the water heater, and (2) the 2-section, or bleeder type, where water at 90-100 F is drawn from an early section for certain washroom processes, the remainder going on through other section of reclaimer, and on to the water heater.

MRM says discharge temperature is about 120 F. Using tempered water for the break and some of the rinse water brings drain temperature to around 110 F, and the tempering section of the reclaimer lowers the final drain temperature to 62 to 65 F if incoming cold water is 36 to 38 F. Since washroom conditions are not known I cannot suggest a size for the reclaimer, or the resultant temperatures. Sketch 1-*C* shows how a 2-element heat reclaimer is connected.

From a maintenance viewpoint, a reclaimer of header-and-tube construction will probably give better satisfaction, because it is easier to clean. A suitable screen must be placed in the waste-water trench ahead of the reclaimer, to stop lint and other foreign matter from fouling the tubes.

If cold-water rinses are necessary, a second dump outlet leading directly to the sewer could be built into the washer, or a gate arrangement built into drain pipe or trench. General practice is to allow such rinses to pass through the reclaimer with other waste water.

Installation of a suitable reclaimer is an investment that pays for itself many times over.

Milwaukee, Wis. L M LARSON

Which Voltage Is Best for Our Purpose?

(This is Question 2 from the June issue, with best answers from readers.)

Our woodworking plant is driven by line shafts and belts at present. We can get immediate delivery on two 200-kva ac generators, one 440 v and the other 2300 v. I would like to know which voltage we should select to furnish power for individual electric drive to replace the line shafts. We expect to drive the machine with our present 270-hp steam engine.

We now use a 36-kva 440-v diesel-engine-driven ac generator to furnish lights and power for the machine-shop 440-v motors, totaling 11 hp. Load on the main generator would be about 150 kw made up of two 75-hp planers; two resaws, one 50 hp and the other 75; two fans, one 50 hp and the other 25; a 15-hp trimmer, and two conveyors requiring about 7 hp.

Motorizing this equipment will do away with the shafting and considerable belting and should result in an appreciable saving in power.—DW

Buy 440-V Alternator To Match the System

DW SHOULD BUY the 440-v alternator and tie in with his present system. This eliminates two different plant voltages and the necessity for changing 440-v motors. He also avoids buying transformers to reduce the 2300-v power.

Small motors, of which he has several, are not standard in 2300-v ratings. There is less danger in *DW's* woodworking plant with 440-v equipment. He may also want to operate the new alternator in parallel with the present 440-v machine.

Shreveport, La. J E VALLERY

440-V Equipment Is Less Expensive

DW SHOULD FAVOR the 440-v equipment for several reasons:

1. Cost of motors and control devices for his machines would undoubtedly be cheaper. The 2300-v system requires extra precautions in construction to provide greater insulation and wider spacing of contacts in switching equipment. Small motors do not justify these costs.

2. A 440-v system is much more flexible and adapted to changes than a 2300-v system. For example, should *DW* desire to add a 2-hp motor to his system he could do so easily and economically in a 440-v system. If 2300 v were used he would have to provide a transformer and a 2300-v switch that would be expensive

for the small-sized motors to be used.

3. *DW's* existing system could be directly tied in with a new 440-v system. This should be a big advantage as under many conditions he could operate entirely on the big set. Even if not desirable for steady operation it would be a great help in a breakdown of either set.

4. Maintenance of 440-v equipment requires less skill and fewer special instruments than 2300-v. Repair parts are more readily available for 440-v equipment, whereas small 2300-v motors are not available.

Saint Clair Shores, Mich. M H ELKIN

Low-Voltage Generator Is the Best Selection

BY ALL MEANS take the 440-v machine for this job. Wiring and starters for the motors cost a lot less. No saving could be made on 2300 v unless the machines were widely separated. This is not likely since they are now lineshaft driven.

Motors below 25 hp would be 440 v normally and not 2300 so transformer capacity would have to be provided for the smaller sizes. This and the much higher cost of 2300-v starters would overcome the savings in copper and wiring for the higher-voltage motors. The 440-v motors in 50- and 75-hp sizes require heavy copper feeders, but switches and starters are much cheaper for the lower voltage. Present 36-kva 440-v diesel set fits right in without transformers if 440 is used throughout. There is also a certain element of safety in using 440 v but the installation should not be cheapened on that account. All things considered, lower voltage is preferable here.

Carlsbad, N. M. E A ROBERTS

440-V System Is Simpler

SELECTION OF 2300 v for *DW's* generator is open to several objections. Generally speaking, motors of 50 hp and under are more readily available for voltages below 600 v.

Cost of starting equipment for 2300 v is about 80% higher than cost of similar equipment for 440 v. Wiring for 2300 v should be lead-covered cable, whereas an ordinary wire and conduit job is all 440-v motors require. These costs should be about equal.

Use of 2300 v requires transformers to reduce to 440 v for the trimmer and conveyor motors.

In view of these factors and the short length of circuits in a plant of this nature, voltage should be 440.

There will be some difficulty maintaining voltage when the larger motors are starting. Motors should be selected with a low starting current. Wound-rotor motors might be advisable for 75-hp drives.

Hamilton, Ont. J A COULDEN

Economics Favor 440 V

IF DW LOOKS into the price and availability of 2300-v and 440-v motors, he should have no difficulty deciding which voltage to install.

Motors required are all moderate to small in size and even now a considerable number of 440-v motors are available in the used-motor market, while in normal times they are readily available from manufacturers' stocks.

The 2300-v motors cost about 25% more than 440-v motors in small sizes while switchgear and wiring for 2300-v installations are much more expensive than for 440-v.

Cost of entire installation is all in favor of the 440-v job while operating economies of the 2300-v system would be minor, if any, especially for a woodworking plant that probably uses considerable waste for fuel.

Piney River, Va. IRA A BUTCHER

440-V Generator Is Cheaper

CONSIDERING THE TYPE of service for which the power is intended. *DW* should take the 440-v unit. I assume the new unit will be adjacent to the woodworking plant, and therefore no transmission line of length is necessary. Use of the steam engine with steam generated by woodwaste also points to this. Therefore, *DW* should plan his feeder system from the power plant, taking into consideration feeder runs, voltage drop, and future installation or changes of machines. An eye on the future now will save money and work. If *DW* chooses the 2300-v unit he has transformers and related equipment to consider, both for installation and maintenance. He probably plans to use 440 v on all machines anyway, and inasmuch as the woodworking plant should be more or less compact, he should choose the 440-v unit. If the plant equipment were widely scattered with considerable distance for feeders involved, he would necessarily take the 2300-v unit.

Shiprock, N. M. J F MAHER

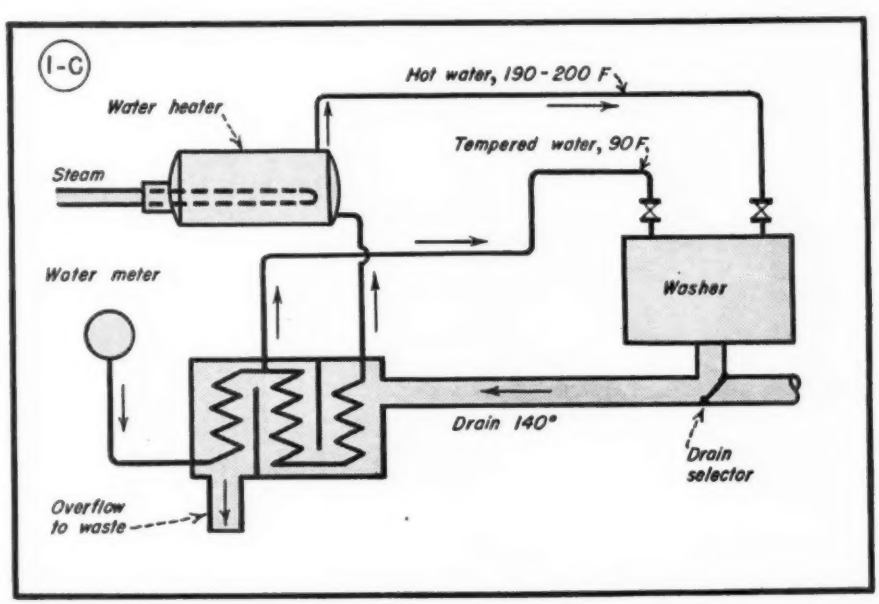
440-V System Costs Less to Install

FROM AN ECONOMIC STANDPOINT, *DW* will find that 2300-v equipment costs about $4000 more than 440-v equipment. This covers price of motors and control equipment. Installation costs run substantially the same for both voltage classes. This cost comparison does not include the one 15-hp and two 3½-hp motors, which should be 440 v. If remainder of plant is designed for 2300 v these three motors may be supplied from the existing 36-kva 440-v ac generator.

To determine distribution-cable costs an average feeder length of 200 ft was assumed. Installed feeder cable costs about $1000 more for 440-v motors than for 2300-v. This cost is lower if circuit length to individual motors is less. Hence *DW's* plant may be installed and served more economically at 440 v than at 2300 v.

He should consider installation of a 50-hp synchronous motor to drive one fan. Then he can correct the lagging power factor of the other induction-motor

(*Continued on page* 148)



CENTRIFUGAL PUMP Q&A FOR POWER ENGINEERS

By I J Karassik and Roy Carter

18—Troubles: Their Symptoms and Causes

Eighteenth in a monthly series by Igor J Karassik and Roy Carter, Worthington application engineers. These two experts on centrifugal pumps have selected questions and answers that give a broad, practical understanding of the pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—What are the commonest symptoms of troubles and what do they indicate?

A—Symptoms may be hydraulic or mechanical. In the hydraulic group, a pump may fail to discharge or it may develop insufficient capacity or pressure, lose its prime after starting, or take excessive power. Mechanical symptoms may show up at the stuffing boxes and bearings, or in pump vibration, noise or overheating. See chart, page 116, for symptoms of pump trouble and possible causes. For example, take the first symptom, "Pump does not deliver water." There are eleven possible causes, listed as 1, 2, 3, 4, 6, 11, 14, 16, 17, 22 and 23, all of which are defined in lower part of chart.

Q 2—What is wrong when a pump "crackles"?

A—If a pump produces a crackling noise, suction conditions generally cause it. Most centrifugal pumps operating in the break because of excessive suction lift produce a crackling noise. This, however, is not true of hotwell pumps, which are often designed so they normally operate in the break and thus are automatically controlled as to capacity.

Q 3—What is wrong when a pump "rumbles"?

A—A rumbling noise is generally caused by conditions in the discharge. A pump may rumble when it operates at part or excessive capacity.

Q 4—What causes a pump that operates satisfactorily under full discharge capacity to lose its suction when throttled to a lower rate of flow?

A—Air leakage into the pump may cause this condition. At full discharge, fluid velocities in the pump's casing are sufficiently high to wash the air constantly into the discharge pipe. At reduced capacity, the lower fluid velocities may not wash out the air and it accumulates in the casing top until the pump loses its prime.

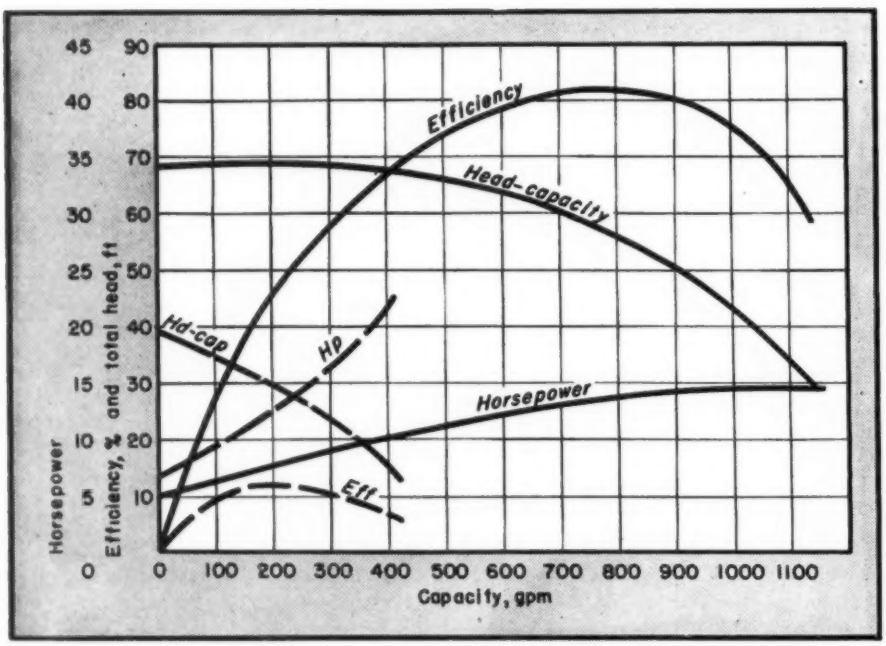
Q 5—What causes water hammer in the discharge line?

A—Sudden change in velocity of a liquid column causes this trouble. It is usually serious only in long pipelines.

Q 6—How can water hammer be prevented?

A—Have the discharge valve closed when starting the pump. Then open this valve slowly after the pump is started to increase liquid's velocity gradually in the pipeline. When stopping the pump, first close the discharge valve slowly, then stop the pump. This method is not suitable where a pump or pumps may stop suddenly by control or power failure. If water hammer may reach a dangerous magnitude, it can be prevented by installation of a slow-opening and slow-closing check valve. Flow is gradually increased during starting and decreased during stopping. Reverse flow may occur but it is gradually stopped.

In other applications a special protective valve is used. This valve opens quickly with pressure drop, which is part of a water-hammer cycle, and then closes slowly to throttle the resulting back flow. Air-charged surge tanks or air chambers have also been used satisfactorily. Because a motor-driven pump stops delivering water almost instantaneously after

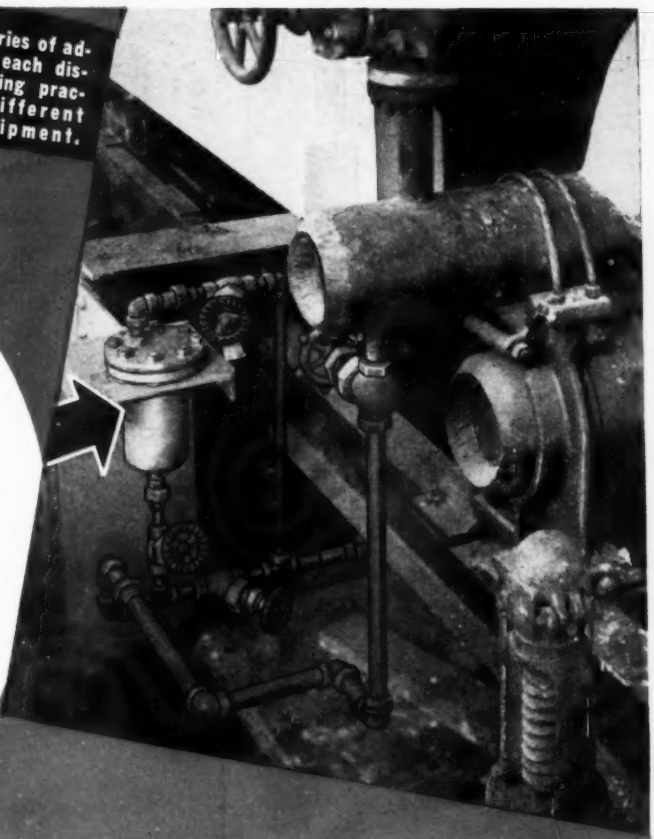


Head-capacity, power and efficiency curves for one design of centrifugal pump operating in the correct direction of rotation, also when rotation is reversed

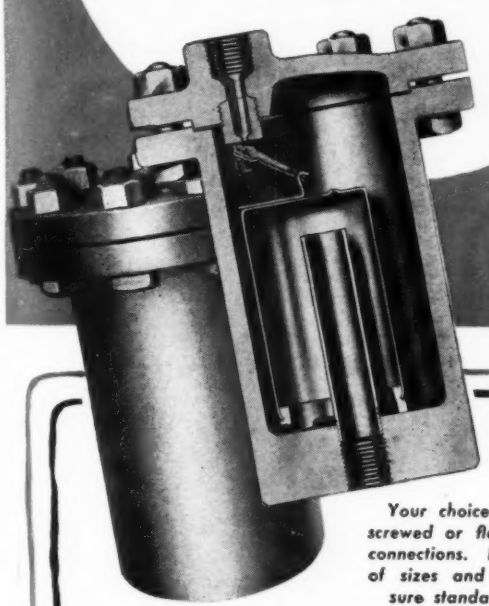
Photo shows trap draining boiler superheater header.

One of a series of advertisements, each discussing trapping practice on a different class of equipment.

HOW TO TRAP HIGH PRESSURE STEAM LINES



—for dependable, trouble-free service



Your choice of screwed or flanged connections. Range of sizes and pressure standards.

QUALITY CONSTRUCTION!

- **VALVE AND SEAT.** Special chrome steel (stainless), hardened, ground, and lapped in matched sets.
- **INTERNAL TRIM.** All-stainless 18-8. Includes inverted bucket, valve lever, and guide pins.
- **CAP AND BODY.** Die forging (SAE 1030), 70,000 lbs. tensile strength.
- **BOLTS.** Supertemp, 149,000 lbs. tensile strength.
- **NUTS.** Hex, semi-finish (SAE 1030).

ARMSTRONG FORGED STEEL STEAM TRAPS

IT'S EASY to get dependable, trouble-free, high pressure trap installations when you use Armstrong Forged Steel Traps and follow Armstrong recommendations. On page 19 of the Armstrong Steam Trap Book (ask for a copy) you will find complete information on figuring condensate loads . . . selecting proper size of trap . . . arranging piping for greatest convenience and best drainage.

Here are some tips. Calculate the "warming up" load as well as the normal radiation loss load. Consider the possibility of sudden loads due to "carry-over" or opening of closed valves. Use a trap sizing safety factor of 2 or 3 to 1, except when pressure loss in long connecting lines may make a higher factor advisable. If possible, install traps close to and below source of condensate. If check valves are needed, consider the use of Armstrong internal type check valves. ARMSTRONG MACHINE WORKS, 812 Maple St., Three Rivers, Mich.

ARMSTRONG *Inverted Bucket* STEAM TRAPS

Over a Million in Use...For Power...Process...Heating

PUMP Q&A

Continued

power cutoff, water hammer can be more serious than if the pump stopped slowly. In a few high-head installations, a flywheel has been added to the pumping unit to increase the stopping time. Even though actual pumping stopping time is increased only slightly it is sufficient to reduce water hammer materially.

Q 7—Will the effect be the same when the discharge line breaks near a pump as when the break occurs some distance from it?

A—When the discharge line breaks near the pump, the head drops to a low value causing the pump to deliver nearly its maximum capacity. On some installations, this overloads the pump's driver dangerously. When the break is some distance from the pump, the longer length of pipe in the flow line limits pump capacity to a smaller value and lower power requirements.

Q 8—What effect does running a pump backwards have on its operation?

A—Reverse direction of rotation causes a large drop in head and capacity, a sharp rise in power and a resulting efficiency decrease, curves, p 114. Pump has 800-gpm capacity under 55-ft head at best efficiency. On reverse rotation its capacity drops to 200 gpm at 30-ft head and its efficiency decreases from 82 to 12%. The head-capacity curve drops sharply on reverse rotation and the horsepower curve rises steeply.

Q 9—How can one determine the approximate runaway speed of a pump under reverse flow?

A—Runaway speed with reverse flow depends upon pump type and net head. With an effective head equal to the pump's design head, runaway speed varies from a maximum of about 175% of rated value for low-head high-specific-speed propeller pumps to less than rated speed for high-head low-specific-speed designs. Pumping head on most systems includes static and frictional. When reverse flow occurs the net head, which is static less friction, is usually considerably less than normal pumping head, which was static plus friction. The lower net head for reverse flow results in a lower runaway speed than would exist if net head during reverse flow equalled the design head.

Q 10—What effect does air leaking into the suction line have on performance, when a pump operates on a suction lift?

A—A small amount of air leaking into the suction is carried through the pump. This ability to carry a small amount of air through the pump's passages is used in some installations to add air to the tank of pneumatic-pressure water systems. Air leaking into the suction and passing through the pump, reduces the pump capacity and power required. If air leakage into the suction is sufficient the pump cannot purge itself and loses its prime.

Q 11—Some noisy pumps, operating with a suction lift, can be quieted by allowing a small air leakage into the suction. Is this good practice in pump operation?

A—No. Admission of air into the suction line quiets some pumps in which noise is produced because of excessive suction lift. The air cushions cavitation occurring in the impeller. Air needed for this varies with the pump's capacity. Capacity variation because of variation in operating head requires different amounts of air. Presence of air generally has an adverse effect on pump efficiency and may accelerate corrosion. In addition, air in the pumped water is generally undesirable. When a small amount of air leaking into the suction lines quiets a noisy pump it indicates that the cause of the noise is on the suction side, but this leakage of air into the suction lines is not the correct remedy for the trouble.

CHECK CHART FOR CENTRIFUGAL PUMP TROUBLES

TEN SYMPTOMS	POSSIBLE CAUSE OF TROUBLE (Each number is defined in the table below)
Pump does not deliver water:	1—2—3—4—6—11—14—16—17—22—23
Insufficient capacity delivered:	2—3—4—5—6—7—8—9—10—11—14—17—20—22 23—29—30—31
Insufficient pressure developed:	5—14—16—17—20—22—29—30—31
Pump loses prime after starting:	2—3—5—6—7—8—11—12—13
Pump requires excessive power:	15—16—17—18—19—20—23—24—26—27—29—33 34—37
Stuffing box leaks excessively:	13—24—26—32—33—34—35—36—38—39—40
Packing has short life:	12—13—24—26—28—32—33—34—35—36—37—38—39—40
Pump vibrates or is noisy:	2—3—4—9—10—11—21—23—24—25—26—27—28 30—35—36—41—42—43—44—45—46—47
Bearings have short life:	24—26—27—28—35—36—41—42—43—44—45—46—47
Pump overheats and seizes:	1—4—21—22—24—27—28—35—36—41

FORTY-SEVEN POSSIBLE CAUSES OF TROUBLE

Suction Troubles

1. Pump not primed
2. Pump or suction pipe not completely filled with liquid
3. Suction lift too high
4. Insufficient margin between suction pressure and vapor pressure
5. Excessive amount of air or gas in liquid
6. Air pocket in suction line
7. Air leaks into suction line
8. Air leaks into pump through stuffing boxes
9. Foot valve too small
10. Foot valve partially clogged
11. Inlet of suction pipe insufficiently submerged
12. Water-seal pipe plugged
13. Seal cage improperly located in stuffing box, preventing sealing fluid entering space to form the seal

System Troubles

14. Speed too low
15. Speed too high
16. Wrong direction of rotation
17. Total head of system higher than design head of pump
18. Total head of system lower than pump design head
19. Specific gravity of liquid different from design
20. Viscosity of liquid differs from that for which designed
21. Operation at very low capacity
22. Parallel operation of pumps unsuitable for such operation

Mechanical Troubles

23. Foreign matter in impeller
24. Misalignment
25. Foundations not rigid
26. Shaft bent
27. Rotating part rubbing on stationary part
28. Bearings worn
29. Wearing rings worn
30. Impeller damaged
31. Casing gasket defective permitting internal leakage
32. Shaft or shaft sleeves worn or scored at the packing
33. Packing improperly installed
34. Incorrect type of packing for operating conditions
35. Shaft running off center because of worn bearings or misalignment
36. Rotor out of balance resulting in vibration
37. Gland too tight resulting in no flow of liquid to lubricate packing
38. Failure to provide cooling liquid to water-cooled stuffing boxes
39. Excessive clearance at bottom of stuffing box between shaft and casing, causing packing to be forced into pump interior
40. Dirt or grit in sealing liquid, leading to scoring of shaft or shaft sleeve
41. Excessive thrust caused by a mechanical failure inside the pump or by the failure of the hydraulic balancing device, if any
42. Excessive grease or oil in antifriction-bearing housing or lack of cooling, causing excessive bearing temperature
43. Lack of lubrication
44. Improper installation of antifriction bearings (damage during assembly, incorrect assembly of stacked bearings, use of unmatched bearings as a pair, etc.)
45. Dirt getting into bearings
46. Rusting of bearings due to water getting into housing
47. Excessive cooling of watercooled bearing resulting in condensation in the bearing housing of moisture from the atmosphere

Tops FOR TOP PRESSURES

On steam lines where pressures go as high as 1500 psi, and temperatures up to 900° F. are encountered, steam traps must be rugged . . . and *efficient!*

That's why so many public utilities and other high pressure steam plants are installing Yarway Integral Strainer Impulse Steam Traps. First cousin to the famous standard Yarway Impulse Steam Trap, the integral strainer trap has been developed especially to meet high pressure trapping requirements.

It has ample condensate capacity when system is being "warmed up." Yet it will handle relatively small amounts of condensate efficiently without losing prime. The valve closes positively in the presence of dry or superheated steam.

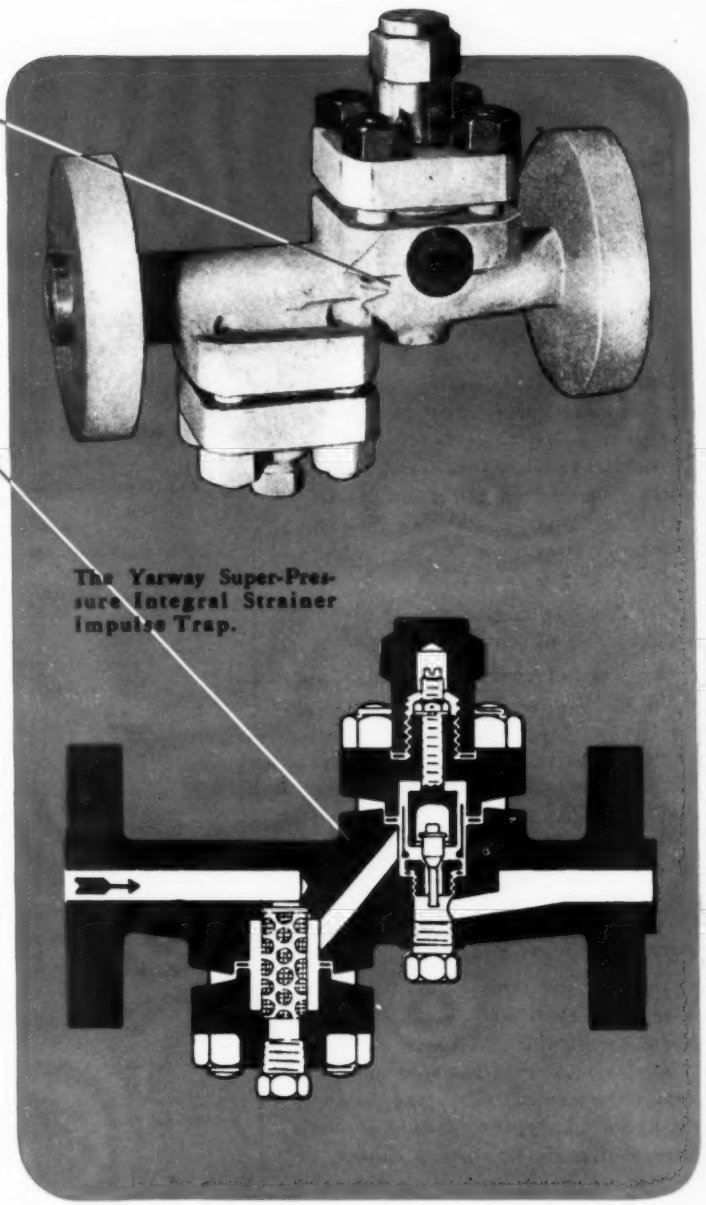
It is a fraction of the size and weight of other type traps designed for the same service—saving space, simplifying installation and requiring no supports.

It is suitable for all pressures within a wide range without change of valve or seat.

It has the same simplicity of design as does the standard Impulse Trap shown below—only one moving part, the same little valve.

Its integral strainer protects trap against scale and rust in the piping system.

Available with flanged or socket weld connections. Write for Bulletin T-1739.



The Yarway Super-Pressure Integral Strainer Impulse Trap.

The Standard Yarway Impulse Steam Trap. Note only one moving part — a little valve.

See these traps and other Yarway steam plant equipment . . . hear their operation described by Lowell Thomas in the Yarway color motion picture, "There Is An Engineering Reason." Available without charge for group showings. Write today.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

YARWAY IMPULSE STEAM TRAP

WATER-TREATMENT QUESTION BOX

HOW COLLOIDS ACT INSIDE A BOILER

By K M Herstein and John S G Shotwell

▶ THIS FOURTH QUESTION in the water-treatment series considers colloids and how they affect scale formation.

Goodwater Laboratory
Drum City, U. S. A.
Dear Chemist:

We have had several discussions about colloids and would like you to explain what they are and their use in feedwater treatment.

Yours truly,
Walter Tender

Dear Walter:

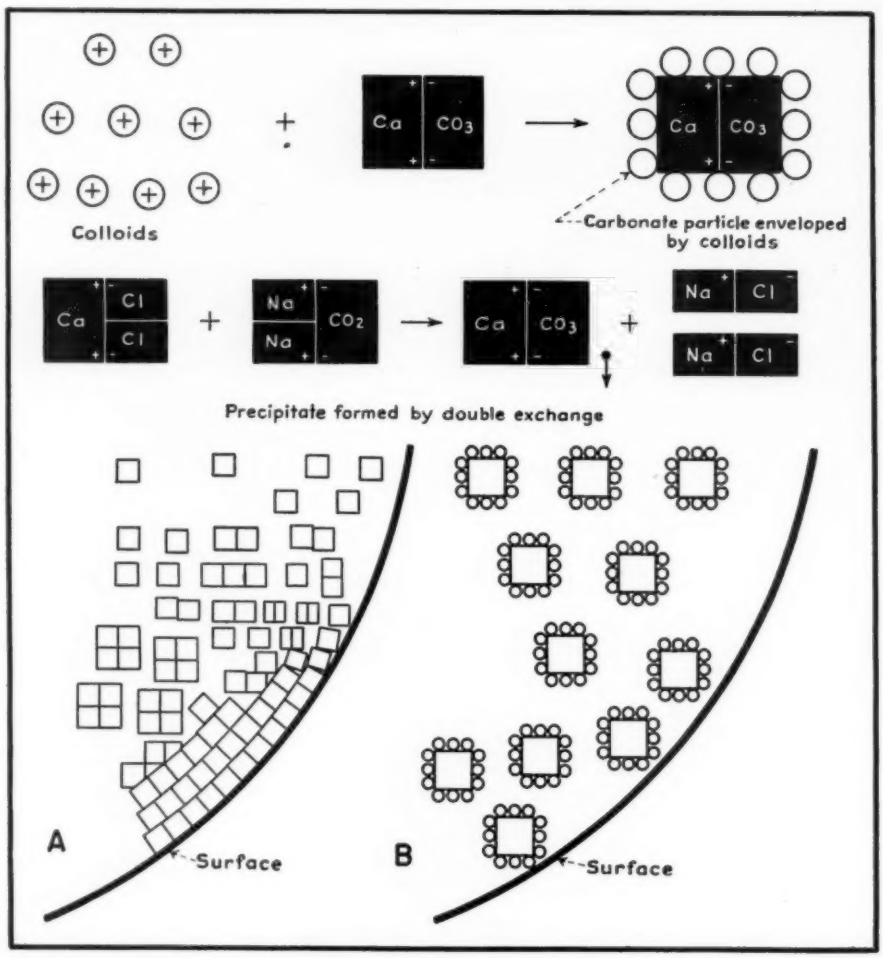
Colloids are substances divided into extremely fine particles less than a millionth of an inch in diameter, suspended in gas or liquid. They (1) do not settle out because they are extremely small and (2) do not come together because they are electrically charged. We cannot see colloidal particles themselves, but if a beam of light passes through a colloidal suspension the particles reflect the light and are illuminated. Consequently we see a beam of illuminated particles, not a beam of light. The path of a searchlight directed into the atmosphere is such a beam.

Common liquids such as milk and solutions of starch, glue and soap are actually colloidal suspensions, not true solutions. When concentrated, they tend to form gels, and similarly, the addition of small amounts of acids or alkalies causes the particles to come together, cling, and form jellylike clots. In clotting, they envelop nearby small particles of solid matter just as drops of rain, mist or fog form around minute particles in the air, thereby leaving it much clearer and purer immediately after a hard rain.

In their reactions colloidal materials, both organic and inorganic, do not progress by straight chemical exchange, grain for grain, or pound for pound, as dancers exchange partners at a barn dance. Rather, they cluster around a scale-former like GI's around a gorgeous redhead. Their exact reactions are often not thoroughly understood—a fact that, combined with their complex structure and long names, has increased the mystery about them. The main purpose of colloids in feedwater treatment is to form a protective envelope around the particles of scale-producing solids as they form and thus prevent their adhering to each other or to boiler surfaces.

Starches and tannins are protective colloids that can be dispersed in boiler water to permit carrying larger contents of scale-forming solids without producing scale. Other organic colloids are made from seaweed, hemp, bark, sugar cane, and resins both natural and synthetic. Some of these seem to have the property of selectively removing calcium and magnesium. Iron compounds are primarily used as oxygen scavengers, but they have some coagulating effect as well.

Yours truly,
Chemist
Goodwater Laboratory



Colloids cluster around the particle (top) rather than exchanging chemically to precipitate the scale former (middle). Scale-forming particles stick to boiler surfaces, A. When enveloped by colloids scaleformers settle without adhering, B.

Beating AN OIL-THROW PROBLEM

SUN LUBRICANT . . .

Stays On the Bearings and Off the Generator Coils; Bearing Temperatures Drop 10°

A manufacturer found that the coils of his generators were being coated with a fine spray of oil leaking from the bearings.

Serious injury to coils and a complete shutdown of the power plant could be possible if the situation were not remedied.

A Sun Engineer studied the problem and suggested a "Job-Proved" Sun lubricant, one that had been used successfully on hundreds of bearings under similar operating conditions.

The oil-throw problem was solved when this recommendation was adopted. Further investigation showed that bearing temperatures had dropped 10°F. As a result, Sun oils have been adopted for all ring-oiled motors and generators in this plant.

For all types of power generating equipment— for Diesels, turbines, steam engines, or electrical units — "Job-Proved" Sun lubricants are highest assurance of long life and continuous operation.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***
Sponsors of the Sunoco News-Voice of the Air—Lowell Thomas

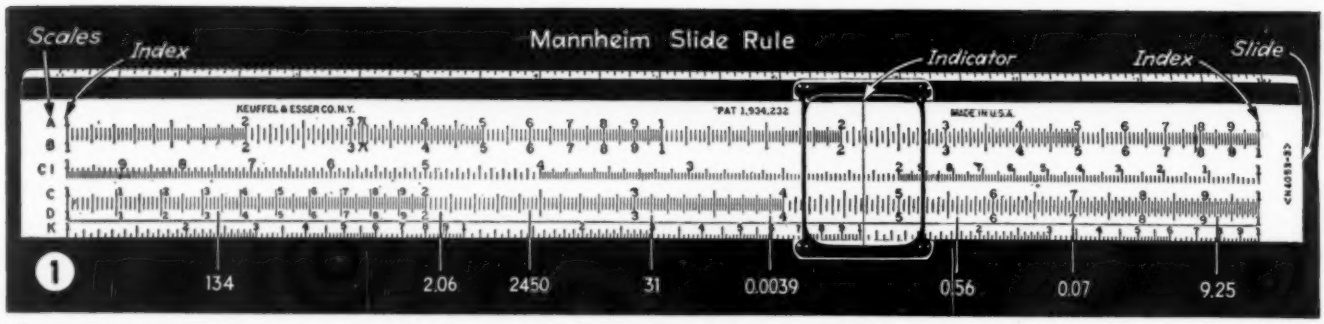
SUN
SUNOCO
INDUSTRIAL PRODUCTS

MATH TIPS

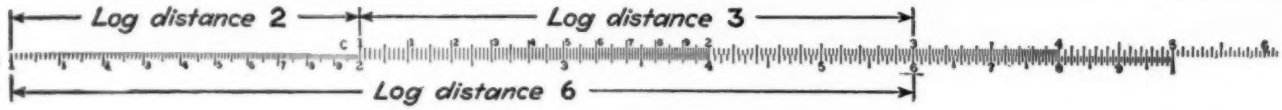
JOHN KING* GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

15—SLIDE RULE:

Engineers' Friend—Part 1



Slide rule**, above solves everyday office and shop calculations rapidly. Below: fundamental steps in multiplication



▶ THE FIRST LINEAR SLIDE RULE, invented about 20 years after logarithms, which first appeared in 1614, was built as a shortcut for proportion. It also multiplies by substituting 1 for one of the terms. That is 1:3 :: 4:12, which is $\frac{1}{3} = 4/12$, or $3x4 = 12$. Today there are many types and varieties of slide rules, which perform almost any operation that can be done with logs, and do it faster.

The average 10-in. slide rule can be read to only three figures but this is generally within engineering accuracy. Therefore it is well worth the time and effort required to learn its use for multiplication, division, proportions, square roots and cube roots. All these operations and more can be performed on the simple Mannheim rule, Fig. 1.

BASED ON LOGS

To better understand the use and operation of the slide rule first consider how it works. We learned in "Logarithms: Time-Saving Invention," p 120, April POWER, that to multiply two numbers you add their logs, to divide you subtract. If a convenient rule, say 10 in. long, were divided proportionally to the logs from 1 to 10 the logs could be read directly from it.

If two rules with identical log scales were mounted side by side the distances representing the logs could be added mechanically by moving one rule along the other. This is the way a slide rule works, except the scales, divided in log values, are marked with the numbers. By this method, to multiply 2x3 the log distance 3 is added to log distance 2; the results equal log distance 6, as above.

Note that log distances on the scale begin at 1 (there is no zero on the slide rule) and continue to 10, also marked 1. Log of 1 is 0 and log 10 is 1, so the multiplying scale of a slide rule (always marked *C* and *D*) increases in logs from 0 to 1 but represents numbers, 1 to 10.

Study Fig. 1 where the important parts of a Mannheim slide rule are labeled.

Problem: $2x4 = ?$

Set the index 1, *C* scale, over 2, *D* scale. Move indicator to 4, *C* scale. Read answer 8 under indicator on *D* scale. With slide in this position note that all numbers on *C* scale are multiplied by 2 and the answer appears directly below on *D* scale. Check this on your slide rule; it works for all number combinations.

Problem: $3x6 = ?$

Set index 1, *C* scale, over 3, *D* scale. Note that 6, *C* scale, extends out past the end of the rule and does not give an answer. When this condition occurs at either end move the other index to the position occupied by the first index. In this case set the index at 10, *C* scale, over 3, *D* scale. Move the indicator to 6, *C* scale, and read the answer 18 (marked small 8) between 1 and 2. How do we know? When the index at the left end of the rule represents 1, the index of the right represents 10 and the numbers between range from 1 to 10. If the left index is 10 the right is 100. If the left is 100 the right is 1000; also if the left index is 0.1 the right is 1, or if the left is 0.01 the right is 0.1. The calibrations between indexes take on values between the limits although numbered from 1 to 10. These arbitrary values are established by the location of the decimal point which will be explained later. Note that these changes are made in the same powers of 10 as shown in the table for "Logarithms: Time-Saving Invention," mentioned. p 120 April, 1936 POWER.

FIND ANY NUMBER

Practice finding these numbers correctly indicated in Fig. 1: 0.0039; 0.07; 0.56; 2.06; 9.25; 31; 134; 2450. Try some numbers of your own selection.

Problem: $6x23 = ?$

Set index 10, *C* scale, over 6, *D* scale. Move indicator to 2 plus 3 main divisions between 2 and 3, *C* scale; answer 138. Do you agree?

Here is the rule for multiplication on the slide rule:

To multiply two numbers locate one of the numbers on the *D* scale and place either the 1 or 10 index of *C* scale over the number. Locate the second number on the *C* scale and move the indicator to this number. (If the second number runs off the *D* scale, use the other index). Answer is under indicator and is always found on the *D* scale.

More about the slide rule next month.

* While Phil Swain is in the South Pacific, for POWER and the other McGraw-Hill publications, observing the U. S. atombomb test, Assistant Editor John L King takes over the Math Tips series.

** Slide rule, courtesy Keuffel & Esser Co., N. Y.

These are the things to look for in BLOW-OFF VALVE Design

And you get them all in EDWARD

Boiler blow-off valves take real punishment. Wide and rapid variations in temperature and the abrasive action of scale blown through the valves are conditions prevalent in blow-down service.

Edward cast and forged steel blow-off valves are built to withstand these conditions — without bulky metal sections that add to weight and cost and distort in service and without additional special parts that complicate maintenance.

Before you specify blow-down valves, investigate Edward designs, and more important, the performance records of Edward blow-off valves in all types of stations.

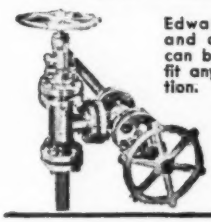
SIMPLICITY

Few working parts to wear, easy disassembly, and wide interchangeability of parts add up to simple maintenance.

TIGHT CLOSURE

Coefficients of expansion of materials are such that an Edward valve closed tight at high temperature is still tight when cooled.

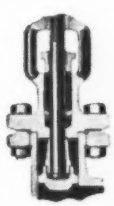
PIPING FLEXIBILITY



Edward straightway and angle designs can be combined to fit any space limitation.

SLOW-OPENING

Slow opening design eliminates damaging shock to piping when valve is operated.



EASY REPACKING

Pressure tested backseats, large stuffing boxes and bolted gland make repacking easy.

STREAMLINED

Smooth internal contours permit free passage for sediment and scale without clogging or eroding parts.

LONG LIFE

For nearly three decades these Edward blow-off valves have been in continuous service in a Chicago plant. A typical case.

SEND FOR CATALOG 12-D

Complete data on designs, dimensions, installations and operating suggestions. Yours for the asking.

Edward Valves, Inc.

SUBSIDIARY OF
ROCKWELL MANUFACTURING CO.

EAST CHICAGO, INDIANA

HOW TO TEST WATER FOR SULPHATES

By C A NOLL, *Chief Chemist, W H and L D Betz*

▶ TEST BELOW is based on the precipitation of sulphate in alcoholic solution by barium chloride ($BaCl_2$) in the presence of tetrahydroxyquinone (THQ) indicator. When the sulphate is completely precipitated, excess $BaCl_2$ reacts with the THQ, resulting in a color change from yellow to rose red.

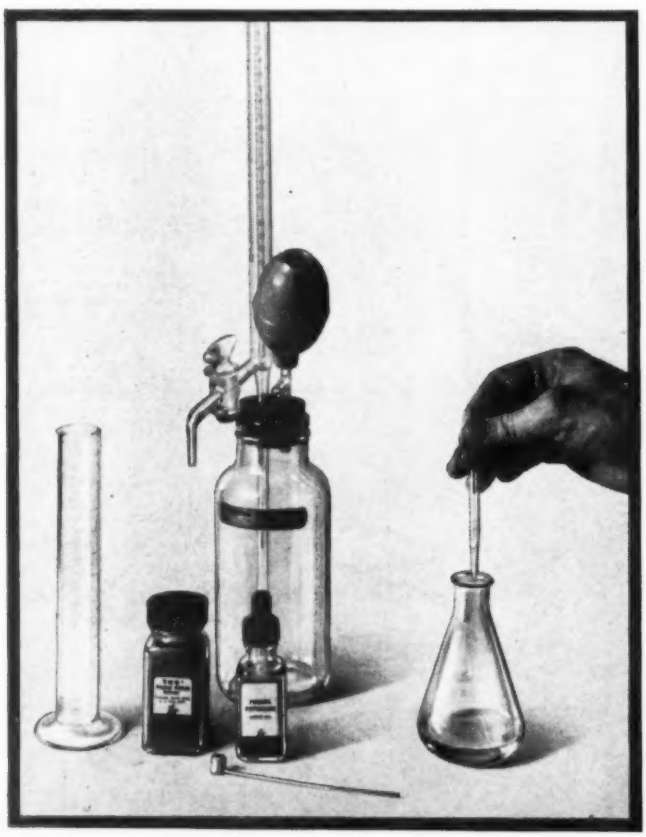
When soluble phosphate is present use bromcresol green indicator instead of phenolphthalein in the neutralizing step and acidify with N/50 hydrochloric acid until the green color just changes to straw. Then continue the standard procedure. This modification carries out the titration at a lower pH, at which up to 60-ppm phosphates as PO_4 do not interfere. For higher concentrations dilute a 5- or 10-ml sample to 25 ml with distilled water, neutralize and titrate as before; multiply the results by the appropriate factor.

For natural waters use $BaCl_2$ solution, 1 ml = 1 mg of SO_4, and subtract a blank of 0.1 ml from the $BaCl_2$ titration. For high-sulphate water use $BaCl_2$ solution, 1 ml = 4mg SO_4. In this case no blank is necessary. For extremely high sulphate concentrations dilute a 5- or 10-ml sample to 25 ml and multiply the results accordingly.

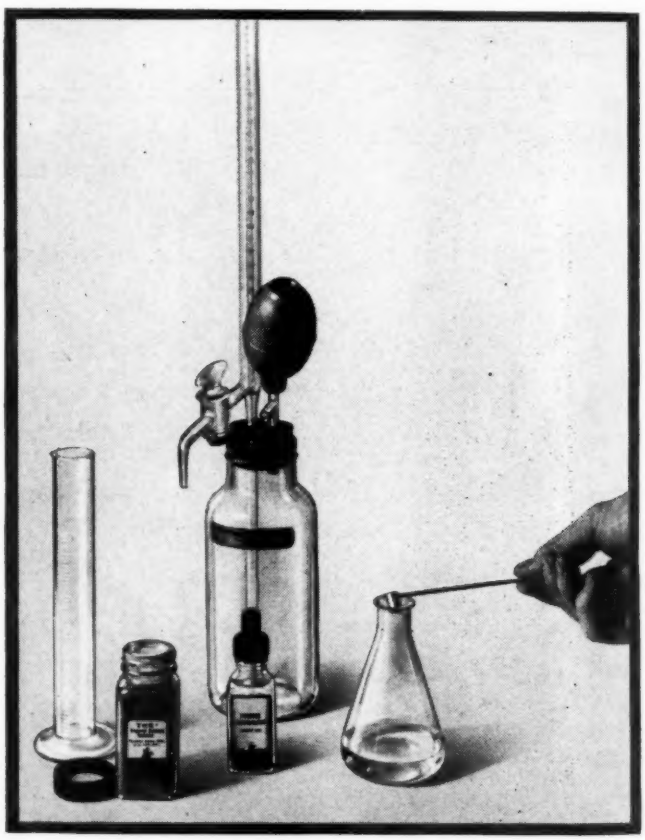
Test Limitations. THQ method is not affected by chlorides, silica, sulphites, tannins, or soluble magnesium, calcium, ferric and ferrous iron. Temperature below 95 F has little effect. It is advisable not to use THQ method for sulphate content below 10 ppm, as SO_4.

Sharpness of endpoint can be increased during titration by adding 1 ml of 2% silver nitrate when chloride content is low, and 3 ml when it is high. When silver nitrate added exceeds chloride content an intense cherry color develops. Remedy: Discard sample; repeat test with less silver nitrate.

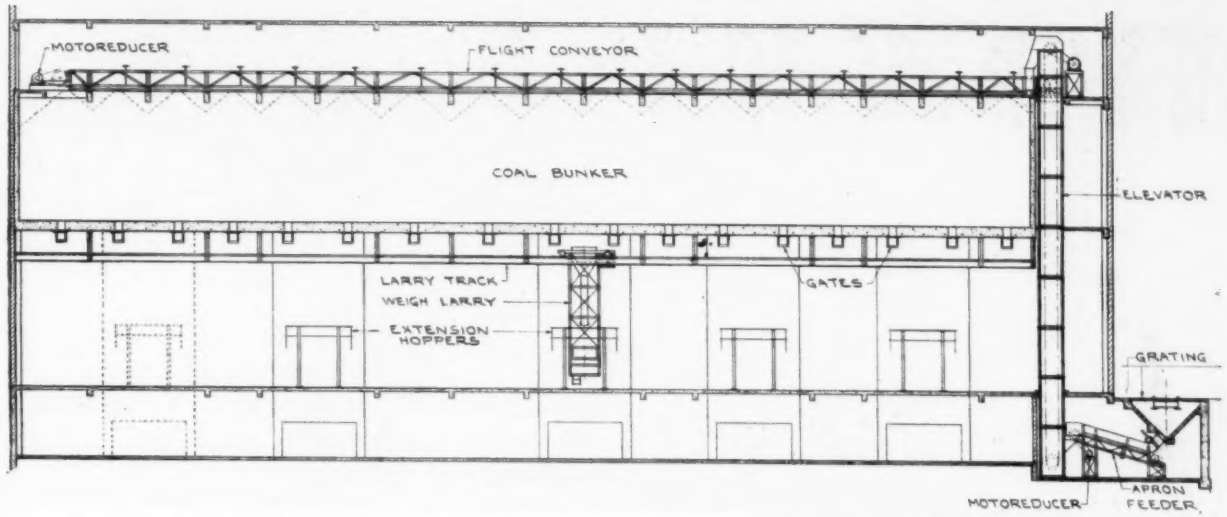
Calculation of Results. Formula: Sulphate as ppm SO_4 = (ml $BaCl_2$ − ml blank) x strength of $BaCl_2$, mg per ml $\times \frac{1000}{\text{ml sample.}}$ Using a 25-ml sample and $BaCl_2$, 1 ml = 1 mg SO_4; sulphate content is equal to ml of $BaCl_2$ required minus the blank of 0.1 ml, multiplied by 40. If $BaCl_2$ strength is 1 ml = 4 mg SO_4, sulphate content is equal to ml of $BaCl_2$ added, multiplied by 160.



1 Measure 25 ml of clear sample into flask. Add four drops of phenolphthalein indicator and neutralize with N/50 hydrochloric acid until red color just disappears. If sample has total alkalinity above 1000 ppm use 0.5 N hydrochloric acid. If it contains free mineral acids, adjust with sodium hydroxide and hydrochloric acid to just neutralize



2 Add one measuring dipper of THQ indicator. (For samples containing less than 50-ppm sulphate use ½ dipper.) Swirl flask to dissolve the indicator. Add 25 ml isopropyl alcohol (or ethyl alcohol denatured by formula 3A or 30). Titrate the resulting yellow solution with $BaCl_2$. Shake thoroughly until color in flask changes to rose red (endpoint).



Line drawing showing general arrangement of the equipment.

100 TONS or 10 TONS PER HOUR CAPACITY

FAIRFIELD

COAL HANDLING SYSTEMS WILL MEET YOUR NEEDS

• Whatever your requirements may be, Fairfield will design—build—and erect the complete coal handling system to meet your specific condition.

To illustrate—the system shown handles coal automatically from car to concrete bunker to weigh larry to stokers at the rate of 100 tons per hour. In this instance a continuous type elevator deposits coal on flight conveyor which distributes it the full length of the bunker. The motor operated weigh larry feeds coal to stokers as required.

This illustrates but one of many methods of coal handling designed and built by Fairfield which are operating today efficiently—economically—meeting the needs of the individual plant.

Consult a Fairfield Engineer on your coal and ash handling requirements.

View of weigh larry feeding stoker extension hoppers.

THE FAIRFIELD ENGINEERING CO.

Builders of Coal and Ash Handling Equipment

320 CHICAGO AVENUE • • • MARION, OHIO

POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION POINTERS • CONVENTIONS

Skrotzki Becomes Associate Editor

► EFFECTIVE JULY 1, Ben Skrotzki became an associate editor of POWER. In announcing the promotion, Phil Swain, editor, said that Skrotzki's work since joining the staff in June 1945 has been outstanding. Holding degrees in electrical and mechanical engineering from Cooper Union School of Engineering, and with 22 years of engineering in Brooklyn

Edison and Consolidated Edison, Ben has concentrated on serving the interests of POWER's utility-plant readers. He carried a major share of responsibility for the Dec 1945 special section on steam turbines and has also become expert in the field of gas turbines. With L N Rowley, managing editor, he presented a paper on this subject at the recent Midwest Power Conference, and the same team will author a special section on gas turbines planned for POWER's Oct issue.

COMING EVENTS

Sept 10-14—Fourth National Chemical Exposition, Coliseum, Chicago. Chicago section, American Chemical Society, Marcus W Hinson, manager, 330 South Wells Street, Chicago 6, Ill.

Sept 16-18—Meeting, Wm Penn Hotel, Pittsburgh. Industrial Instruments & Regulators Div, ASME, E W Jacobson, c/o Gulf Research & Development Co, Pittsburgh 30, Pa.

Sept 16-20—First National Instrument Conference & Exhibit, Wm Penn Hotel, Pittsburgh. Instrument Society of America, Richard Rimbach, exec secy, 1117 Wolfendale St, Pittsburgh 12, Pa.

Sept 30-Oct 2—Fall meeting, Hotel Statler, Boston. Boston sec, American Society of Mechanical Engineers, Harold King, % General Electric, Lynn, Mass.

Oct 1-4—Meeting, Public Auditorium, Cleveland. Association of Iron & Steel Engineers, John B Harmon, 1010 Empire Bldg, Pittsburgh 22, Pa.

Oct 24-26—Joint meeting, Bellevue-Stratford Hotel, Philadelphia. Fuels Div of ASME and Coal Div of AIME, N E Funk, c/o Philadelphia Electric Co, Philadelphia, Pa.

Oct 28-30—Seventh Annual Water Conference, Wm Penn Hotel, Pittsburgh. Engineers' Society of Western Pennsylvania, K F Treschow, secy, Wm Penn Hotel, Pittsburgh, Pa.

Oct 29-Nov 1—All-Industry Refrigeration Show, Public Auditorium, Cleveland. Refrigeration Equipment Manufacturers Assn, R Kennedy Hanson, secy. 1107 Clark Bldg., Pittsburgh, Pa.

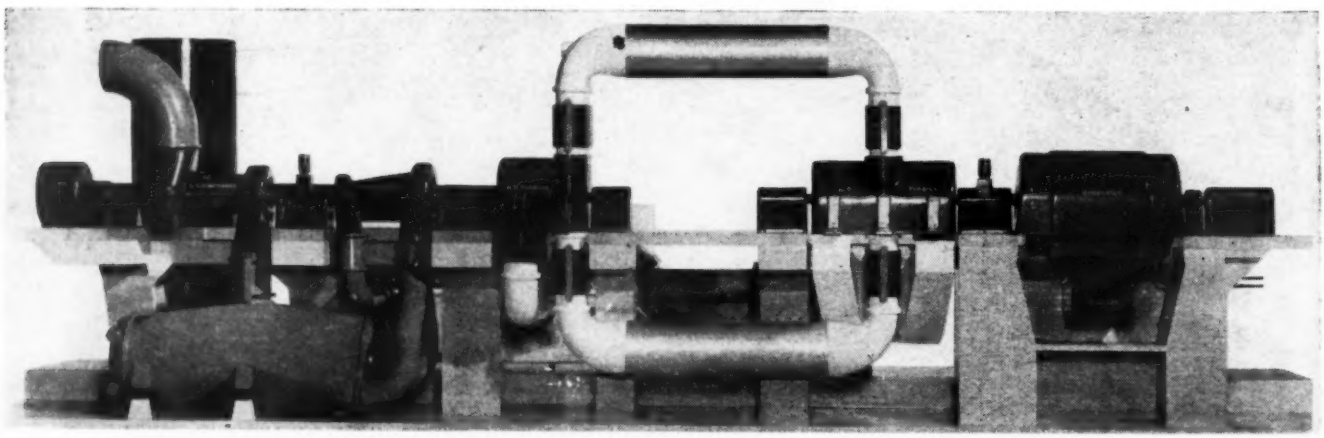
Scale Model Shows Gas-Turbine Design

Scale model of gas turbine, below, believed to be the first commercial design actually proposed for power generation in the utility field, shows how Allis-Chalmers' engineers expect to build a high-temperature high-efficiency version of the most recently developed type of prime mover. Designed for operation at 1300 F, new 10,000-kw gas-turbine-driven power-generating unit will have an efficiency of about 31%, according to R C Allen, manager and chief engineer of steam-turbine dept.

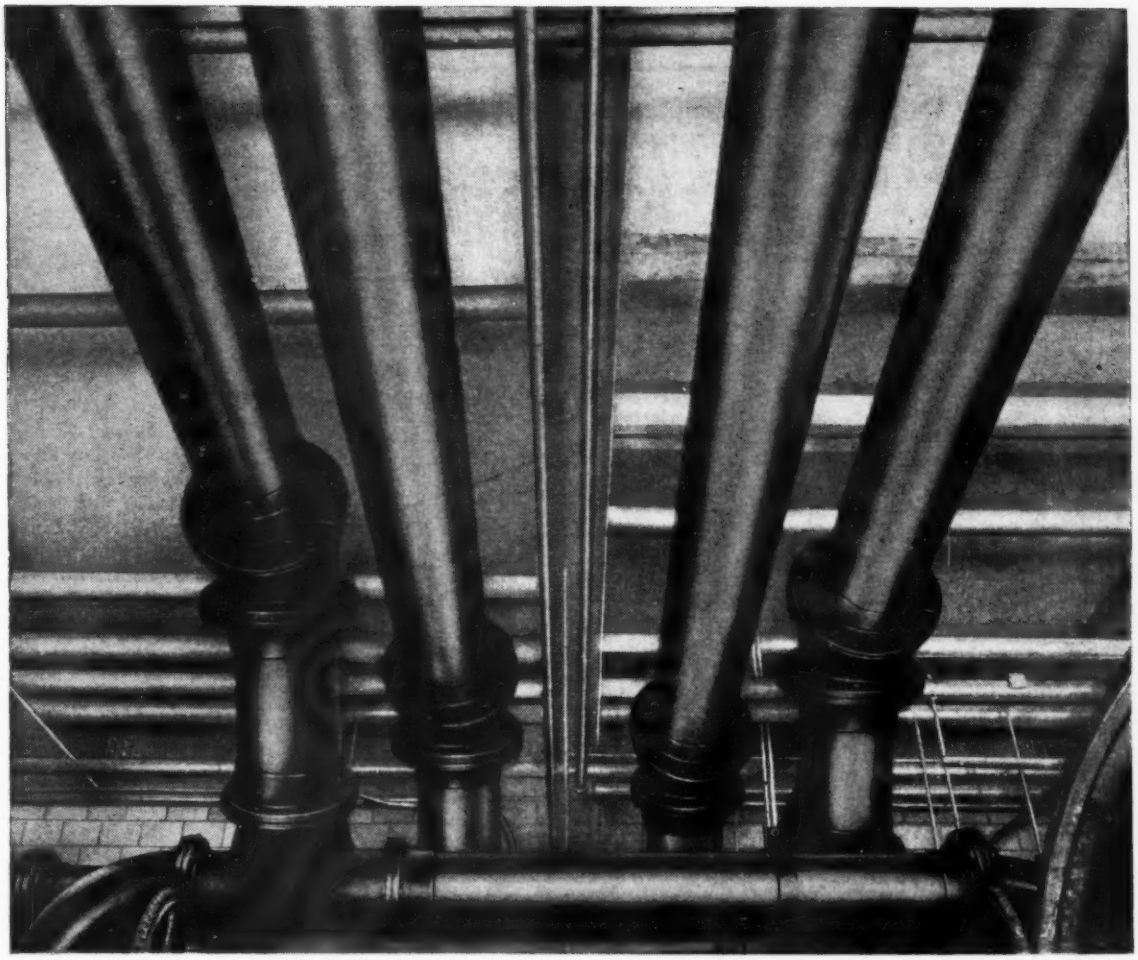
At the same time the company proposed another 10,000-kw unit to operate at 1000 F, with same guarantees as offered with comparable steam-turbine units. Although guarantees call for efficiencies of 15 to 20%, it is believed that such a unit will have an application in power-generation field.

Modeled on a scale of ½ in. to a ft,

(*Continued on page* 178)



Scale model of gas turbine shows how engineers expect to build a 10,000-kw unit for operation at 1300 F



Copper Tubes GO UP TO STAY...

CHECK YOUR EXPENSE in recent years on cleaning, repair and replacement of pipelines . . . and don't forget loss due to down time. You'll find it adds up to a considerable sum . . . most of which would have been saved with *non-rust pipelines.*

Avoid such expense in the future by installing *copper tubes.*

Pipelines of copper rarely need dismantling for cleaning or repairs. And as to replacement, they *outlast* rustable pipe, cost *less* in the long run.

Copper is highly resistant to corrosion by water, steam, oils, refrigerants, and possesses adequate strength. Copper tubes remain smooth and clean inside . . . no rusty scale can form to accumulate built-up deposits.

For these reasons, copper tubes *go up to stay* . . . provide long, economical service. Detailed information on Anaconda Copper Tubes for industrial applications is contained in Publication C-24. Write for a copy. 4008

ANACONDA

Anaconda

COPPER TUBES

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

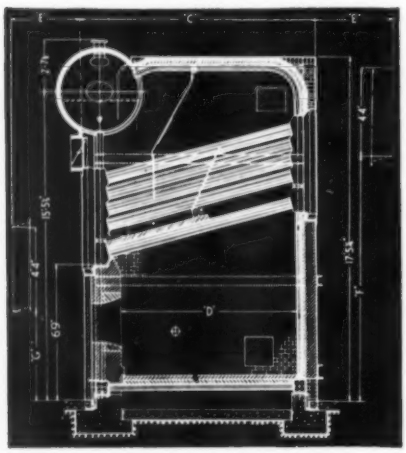
Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

WHAT'S New IN PLANT EQUIPMENT

Standard Boilers

M SERIES LINE of twelve standard watertube boilers ranges in steam-generating capacity from 6000 to 17,000 lb of steam per hr. New boilers feature a watercooled furnace design, which is said to maintain uniformly high efficiency over a wide range of load conditions. Dimensions are standardized for various-sized units. Designed for automatic firing, Type M boilers are made with two standard tube lengths, 10 and 12 ft, expanded into sinuous electric-steel sectional



headers. Furnace width varies from 3 ft, 9 in. to 9 ft, depending on whether 4-, 5-, 6-, 7-, 8-, 9- or 10-header sections are used. All boilers have 48-in. dia welded, X-rayed and stress-relieved steam drum built to pressure standards from 160 to 320 lb. Overall setting height is 17 ft, 5¼ in. for all units.

Erection at user's location is facilitated by shop assembly of a considerable portion of the parts, including header sections with built-in refractory-filled cast-iron baffles. Installation is further simplified by provision of complete structural steel framing to receive standard-dimension refractory and insulating materials. **Dept P, Springfield Boiler Co, 1953 E Capitol Ave, Springfield, Ill.**

Thermostatic Expansion Valve

EASILY TAKEN APART and reassembled for cleaning, thermostatic expansion valve regulates refrigerant flow into evaporator. Feeler bulb is eliminated. Valve is not affected by box temperature, entering warm air or warm suction lines. It responds instantaneously to changed suction-vapor conditions. Sizing the valve to do the job to prevent hunting is unnecessary. It is particularly adapted to modern evaporators with forced air, small tubes, short passes and distributor-header combinations. It is also for small evaporators or modern close-coupled coil and machine combinations.

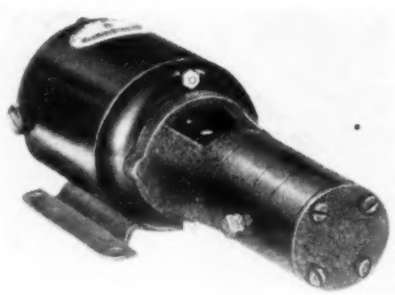
It will close completely above a definite evaporative pressure. Another feature is elimination of special charging and complicated cross charging.

No special installation is required to prevent loss of control by condensing of bulb-control fluid in valve body. An external equalizer is not necessary as compensation for pressure drop in evaporator or distributor has been designed right into the valve. No stem packing is required; novel needle and seal design assure positive closure. **Dept P, Tenney Engrg, Inc, 26 Ave B. Newark 5, N. J.**

Vane Pump

VW-1 POSITIVE-PRESSURE VANE PUMP handles nonlubricating liquids, such as water. Pump has two composition bearings requiring no lubrication beyond that furnished by liquid being pumped. Vanes are made of same material as bearing. By a special design of vanes and by applying proper radii on vane edges, vanes are held in contact with pump chamber. No centrifugal force is required to maintain volumetric efficiency.

Pump is specifically designed for systems having a relief valve and therefore has no bypass valve built into pump design. Shaft sealing is accomplished by a mechanical rotary seal. Delivery is about ½ gal per min. Pump is for operating pressure from 0 to 30 psi and is self-priming. Universal motor is 1/15 hp and is available in either 110 or 220 v, ac or dc. **Dept P, Eastern Engrg Co, New Haven, Conn.**



Refractory Coating

AFTER BEING BRUSHED OR SPRAYED on furnace refractory walls, *Firemaster* refractory coating dries into a seamless monolithic lining that is said to be practically impervious to effects of slag and other products of combustion.

Firemaster fuses, in presence of heat at regular furnace operating temperatures, into a continuous, glass-like substance of high strength and heat-reflecting properties. Its makers state that this seamless lining prevents infiltration of gases into refractory walls, reduces spalling and minimizes accumulation of slag. They also report that the coating improves combustion by sealing air leaks, thus preventing heat loss through the walls, and by reflecting a better percentage of heat back into furnace.

This coating is made in a variety of grades, vitrifying as low as 1000 F, or as high as 3000 F, for all furnaces, burning any fuel. It requires no shutdown other than time taken to apply coating. Furnace is fired immediately after application and operated at normal temperatures. **Dept P, Gamlen Chemical Co, 1469 Spring Garden Ave, Pittsburgh 12, Pa.**

Gas Analyzer

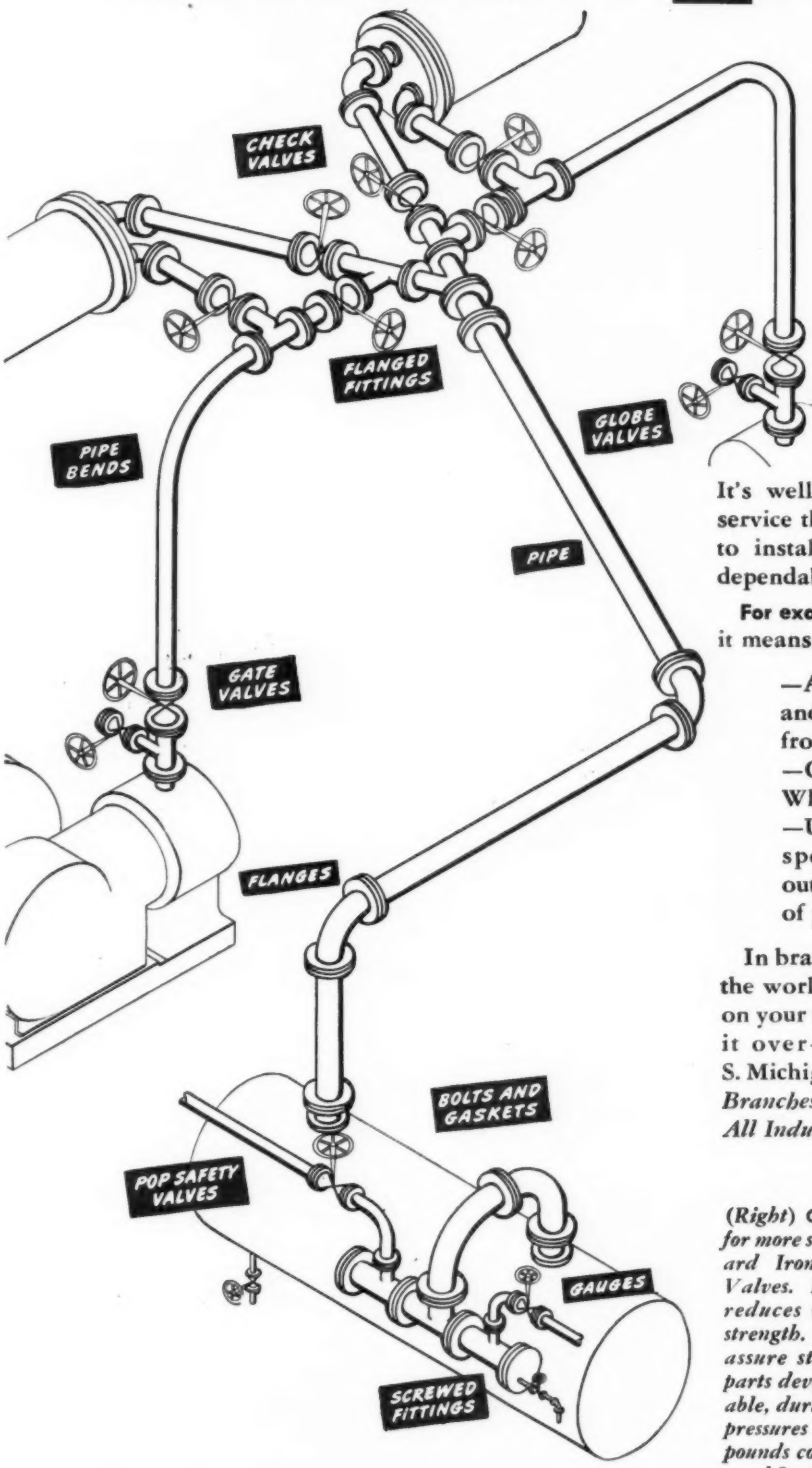
TYPE TB THERMAL GAS ANALYZER continuously records or indicates concentration of one component of mixed gases whose characteristics can be detected by thermal-conductivity principle. New instrument serves over a wide range of gases and gas concentrations. It can detect impurities in hydrogen, carbon dioxide, sulphur dioxide or any one of many organic vapors, provided the impurity has a different thermal-conductivity from that of the gas being analyzed.

To adapt the analyzer to varied applications, a different reference gas can be obtained for each application. A change of the instrument scale and a new cell block, which contains the reference gas, permits an analyzer designed for one atmosphere to be applied to one that is radically different. Gas analysis is registered on any standard

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P

WORTH REMEMBERING!...

CRANE Supplies all Piping Materials



ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

It's well worth remembering and using now—the service that simplifies all your piping jobs from plan to installation. And the one that assures uniform dependability in every part of piping systems.

For example, on this compressor installation, look what it means to have the Crane line for your partner:

—All valves and fittings, pipe, accessories, and fabricated piping units are specified from a single source.
—One order to your Crane Branch or Wholesaler gets them all.
—Undivided responsibility for materials speeds the job. Crane quality throughout guards against untimely breakdowns of piping, and excessive upkeep.

In brass, iron, and steel equipment, Crane gives you the world's most complete selection. There's no limit on your taking advantage of this Crane service. Think it over—now! CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas.

(*Right*) **GREATER ADAPTABILITY** *for more services—Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight yet increases strength. Straight-through ports assure streamlined flow. All parts developed to give dependable, durable service. For steam pressures up to 125 pounds; 200 pounds cold. Patterns for every need. See Crane Catalog, page 101.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

CRANE

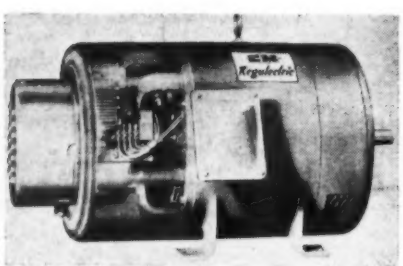
FOR EVERY PIPING SYSTEM

indicating or recording instrument, which can be equipped with contacts for closing an alarm circuit when the concentration reaches a preset maximum or minimum value. In addition, these contacts may serve for controlling circuits for valves or motors to maintain the gas concentration within certain limits. **Dept P, General Electric Co, Schenectady, N. Y.**

Insulation-Resistance Meter

PORTABLE, ENTIRELY SELF-CONTAINED insulation-resistance meter tests to 50,000 megohms (center scale 1200 megohms). Model 261 *Vibrotest* is not just an indicator. It is claimed to provide positive and definite reading of true resistances to this new wide range. Accuracy is said to be insured by hand-stepped scale, calibrated against known standards of resistance. It calibrates at infinity, thus maintaining its definite accuracy at the high value part of scale. It has a high-voltage regulator in measuring circuit. It is equipped with condenser charging circuit to facilitate faster testing of condensers or capacity circuits.

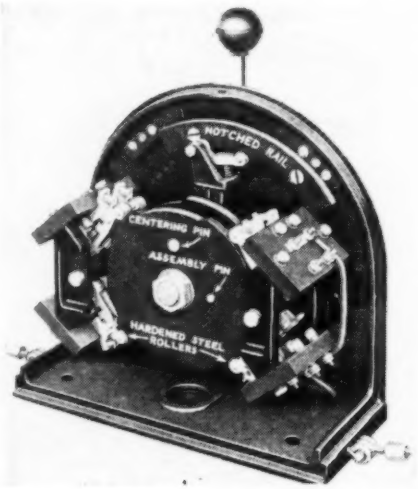
Model 261 does away with cranking. It has its own power supply. Two No. 6 1½-v dry cells provide ample power of 500 v. Meter is tested and checked for temperature variations, from 40 below zero F to 140 F. Model 261 is compactly housed in a weatherproof metal case with carrying strap. **Dept P, Associated Research, Inc, 231 S Green St, Chicago 7, Ill.**



Ac Generator

PRINCIPLE OF ELECTRICAL RESONANCE holds voltage constant in the *Regulectric* ac generator for engine-generator sets. Built-in voltage regulating circuit needs no attention in operation to maintain voltage of power-line quality, according to maker, as regulator has no moving parts and is factory-set to hold voltage within ±2% from no load to full load with normal engine-speed regulation.

Generator, of revolving-field design, is built in these ratings: 5 and 7½ kw, 60 cycle, single phase, 1200 rpm; 7½ and 10 kw, 60 cycle, three phase, 1200 rpm; 7½ and 10 kw, 60 cycle, single phase, 1800 rpm; 10 and 15 kw, 60 cycle, three phase, 1800 rpm. Non-moving electrical components of voltage regulating circuit are built into the *Regulectric*. Only connections required on the job for nonparallel operation are the leads from generator to load through generator switch. **Dept P, Electric Machinery Mfg Co, Minneapolis 13, Minn.**



Master Switch

FOR MILL AND CRANE magnetic controllers, CM master switch is of the cam type, having silver-alloy contacts normally spring-inclosed and opened by 7-in.-dia cams. Large-dia cams are said to result in a saving in motion by operator (short throw—only 37½ deg for a 6-speed-point switch), reduce mounting space required when several switches are installed in a mill pulpit or crane cab (narrow width—8-circuit masters can be mounted on 7⅛-in. centers), making it easy for operator, without changing his position, to conveniently reach and operate them.

Cams are mounted on shaft and keyed in position by a centering pin, screwed into keyed roller-arm bracket. The assembly pin identifies arrangement of cams for right- or left-hand operation. Notched centering-device rail contributes to smooth and easy operation and is located so increased roller-spring pressure is automatically obtained as the lever arm is advanced to the full on position. This offsets weight of operating lever without sacrificing ability to inch between off-position and first points. **Dept P, Electric Controller & Mfg Co, 2700 E 79th St, Cleveland 4, O.**

Diaphragm Control Valves

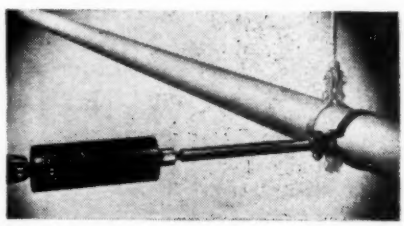
COMPANY OFFERS a full line of diaphragm control valves in sizes ½ to 1 in. in alloy construction, either in 304 or 316 stainless steel, or other special corrosion-resistant alloys obtainable in cast form. Unique feature is a single body casting for each size, this body construction being rated at 600-psi maximum working pressure at 750 F, and also in use of split flanges giving a *Van Stone* joint for ASA pressure ratings of 150, 300 or 600 psi. Standard air-pressure operating range is 2 to 15 psi; other ranges are available. For high-temperature service, air-fin bonnets are obtainable.

Split-flange construction eliminates difficulty of obtaining sound castings in these alloys. A further advantage of split-flange construction is that valves may be changed from point to point for different pressure ratings merely by replacing removable flanges. **Dept P, Hammel-Dahl Co, 243 Richmond St, Providence 3, R. I.**

Electric Hoist

YALE LINE OF MIDGET KING electric hoists now includes a 2-ton model. Formerly unit was available only in ¼- ½- ¾- and 1-ton capacities. Light in weight, yet producing fast lifting power, the compact 2-ton *Midget King* is equipped with a 1-hp motor. Lifting and lowering action is obtained by a flip of the wrist on the one-hand bar-grip control. Operator thus has his other hand free to guide load.

Hoist is available with hook for stationary application and with a permanently attached trolley for use on an overhead track. Accessories include a chain container for collecting slack chain, eliminating kinking and keeping the chain away from worker and load. Special device provides automatic electric-cord support and feed when the *Midget King* is on a trolley. **Dept P, Yale & Towne Mfg Co, 4530 Tacony St, Philadelphia 24, Pa.**



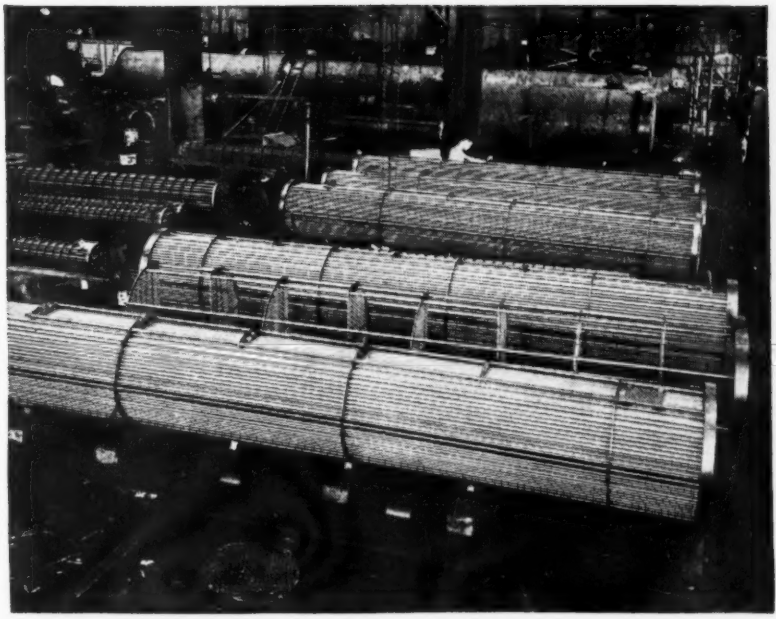
Sway Brace

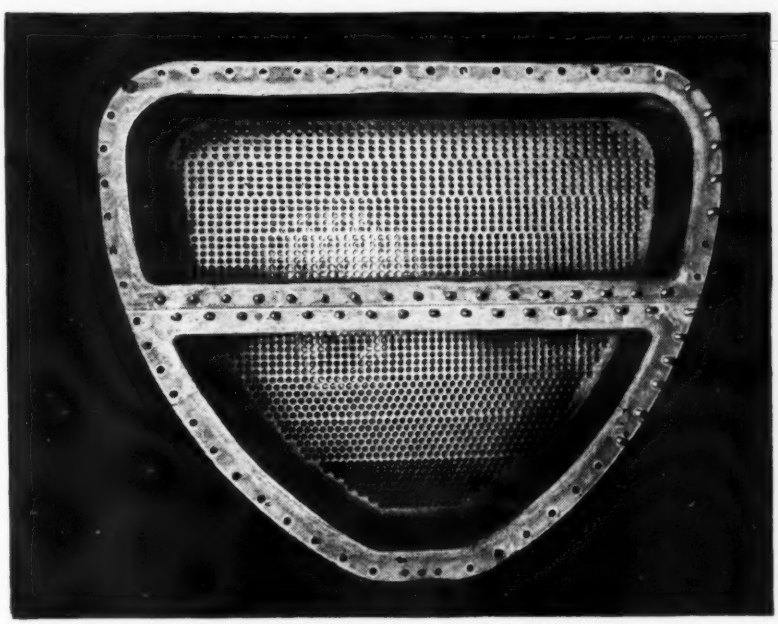
PROVIDING AN INSTANT-ACTING spring force to oppose sway or undesirable movement in piping systems, pre-engineered sway brace does not anchor piping rigidly but permits its movement out of normal position when exciting force is large enough to overcome restraining thrust of its single, pre-loaded, 2-way-acting spring. No forces are exerted on piping when in its normal position. Controlling action serves to bring piping back to normal position in plane of control whenever displacement occurs.

Spring is precompressed between opposed thrust plates. Thrust rod acts on these thrust plates and spring so that either a pull or a push on the rod is resisted by the spring. Amount of this initial resistance to movement of piping is determined by degree of pre-

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P

REVERE
OFFERS
CONDENSER TUBES
and PLATES





• For many years Revere has been a prime and preferred source of supply for tubes and plates required for condensers and heat exchangers in the fields of refining, power production, chemical manufacturing, and on ships.

Revere plates are available in the following: Muntz Metal, Naval Brass, Herculoy (silicon bronze), Cupro-Nickel, Admiralty Metal, and Copper.

Revere Tubes are offered in Muntz Metal, Admiralty Metal, Copper, Revalon (aluminum brass), Cupro-Nickel, Herculoy, Brass.

In addition, Revere manufactures pipe and tube in copper and brass for general piping purposes.

Condenser plates can be had in squares, rectangles, circles, half-circles, segments, and special patterns, up to 120 inches maximum dimension, finished weight about 11,000 pounds maximum. These plates are flat, dense, free from blow holes and other imperfections, accurate in gauge, and are easily machinable.

Revere condenser tubes are available in all the usual sizes and gauges, and are made by the extrusion process, which produces dense, uniform, and highly-corrosion-resistant tubes.

We shall be glad to cooperate with you in studying conditions of use in order to determine the most suitable alloy.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in Principal Cities, Distributors Everywhere.

loading of spring and can be furnished to customer's specifications.

Use of a single spring instead of two saves space, simplifies design, and permits a simple inclosed spring assembly that excludes dirt from working parts. **Dept P, Grinnell Co, 26 W Exchange St, Providence 1, R. I.**

Temperature Recorder

DESIGNED FOR USE with resistance temperature detectors already installed in generators, transformers and other electrical apparatus, Type *CF*-2 inkless temperature recorder can also serve with separate detector units to record temperature in refrigerating machines, air ducts, liquid-handling systems, ovens and heat-treating tanks.

Temperature recorder consists of a portable recording instrument and an external power-supply unit. Equipment records, by an inkless recording mechanism on a 4-in. strip chart, the temperature variations that produce resistance changes in standard 10-ohm resistance temperature detectors heretofore used mainly with indicating instruments. Range of the fixed scale and chart scale on recorder is 20 to 140 C. With a chart length of 65 ft, driving motor can be adjusted to provide record length from eight days to two years on a single chart.

Accessories that can serve with the temperature recorder are a test resistor, leads and resistance temperature detectors of bulb-sheath- or molded-strip type. **Dept P, General Electric Co, Schenectady 5, N. Y.**

Insulation-Resistance Tester

ENTIRELY SELF-CONTAINED, instrument checks insulation resistance in ac and dc equipment. There are no batteries or external power supplies, no brushes or commutators to require attention. The necessary power is provided by a small internal hand generator, which is operated by a crank that can be turned in either direction.

Correct testing voltage is indicated by two small button lights that glow at 500-v dc. When crank is turned faster than necessary an electronic voltage regulator controls voltage to meter so that a true reading is obtained.

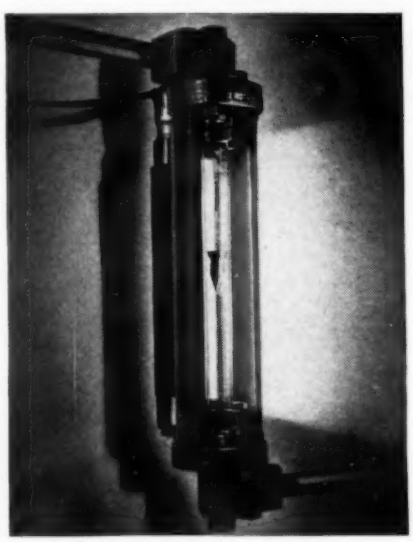
Test range is 0 to 100 megohms; case, lightweight 2-piece aluminum; meter, rugged *D'Arsonval* type; test leads, 10 ft long; dimensions, 3⅜ in. wide x 6 in. long x 3¼ in. high; weight with leather carrying case, 3½ lb. **Dept P, Ideal Industries, Inc, 1025 Park Ave, Sycamore, Ill.**

Stationary Tachometers

WITH 8- 10- AND 20-IN. DIAL, SX stationary tachometers are primarily for heavy-duty long-lasting service, and to give visibility and readability from a distance on large machines or in places where operator of machine has to control speed over a distance. Tachometers are of centrifugal design. They are not affected by temperature variations, are nonmagnetic and operate in either direction of rotation. Tachometers are in a watertight brass case and are flexible, shaft-driven. Tachometers can be furnished to read rpm, fpm, ypm, sheets per min, impressions per min, or per hr, or any other special operation. **Dept P, Herman H Sticht Co, 27 Park Pl, New York 7, N. Y.**

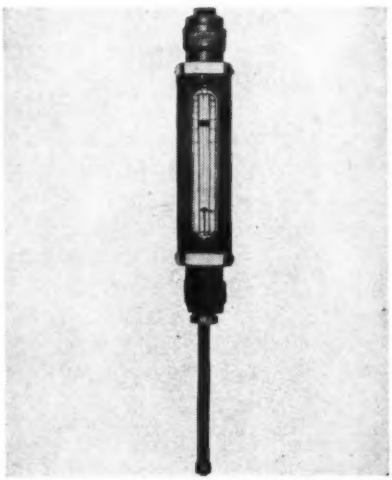
Rotameter Lighting Device

PERFECTED LIGHTING DEVICE, a baked-enamel metal hood with frontal opening, fits snugly against back of *Rotameter* tube and directs a light beam through glass toward operator. Thus rotor and meter scale are clearly outlined even when metered fluid is semi-opaque. Lighting unit may be easily attached to any SK 250-mm-length *Universal Rotameter* by a bracket furnished with each device. Pushbutton socket, 10-ft rubber-covered attachment cord and plug are included. It uses a 110-v, tubular incandescent lamp. **Dept P, Schutte & Koerting Co, 12th & Thompson St, Philadelphia 22, Pa.**



Wire Stripper

No. A-02 TOOL strips from No. 10 to 22 solid or stranded wires. It is said to be as simple and easy to use as a pair of pliers. This pocket-size stripper clamps the wire, cuts the insulation and strips it in one operation. The lever or automatic feature prevents jamming of wires and strands. Blades are renewable. Stripper is also available in other sizes with a wire cutter blade one one side, but fewer stripping notches. **Dept P, Holub Industries, Inc, Sycamore, Ill.**



Continuous Viscosimeter

INSTRUMENT IS CONSTRUCTED to permit instantaneous observation of viscosity values existing in a moving fluid stream under full-line pressure. This viscosimeter is in simple indicating form, or arranged for continuously recording viscosity values on a 24-hr chart, or for controlling fluid viscosity by automatic blending or heating means. The instrument is said to be particularly valuable for continuously blending lube oils, indicating end-points in various plastic processes and in maintenance of constant fuel-oil viscosity for improved oil-burner operation. **Dept 6G-2, Fischer & Porter Co, Hatboro, Pa.**

X-Ray Photometer

INSTRUMENT INDICATES and records concentration of one chemical element in presence of others in solids, liquids or gases. The new instrument, which is nondestructive to most materials, accomplishes this by measuring change in absorption of X-rays between sample and a standard. X-ray photometer serves in such applications as determining ash content of coal, sulphur content of oil, hydrocarbon, chlorine or fluorine content of plastics, tetraethyl lead content of gasoline and bromine concentration in certain brominated compounds. Sensitivity of

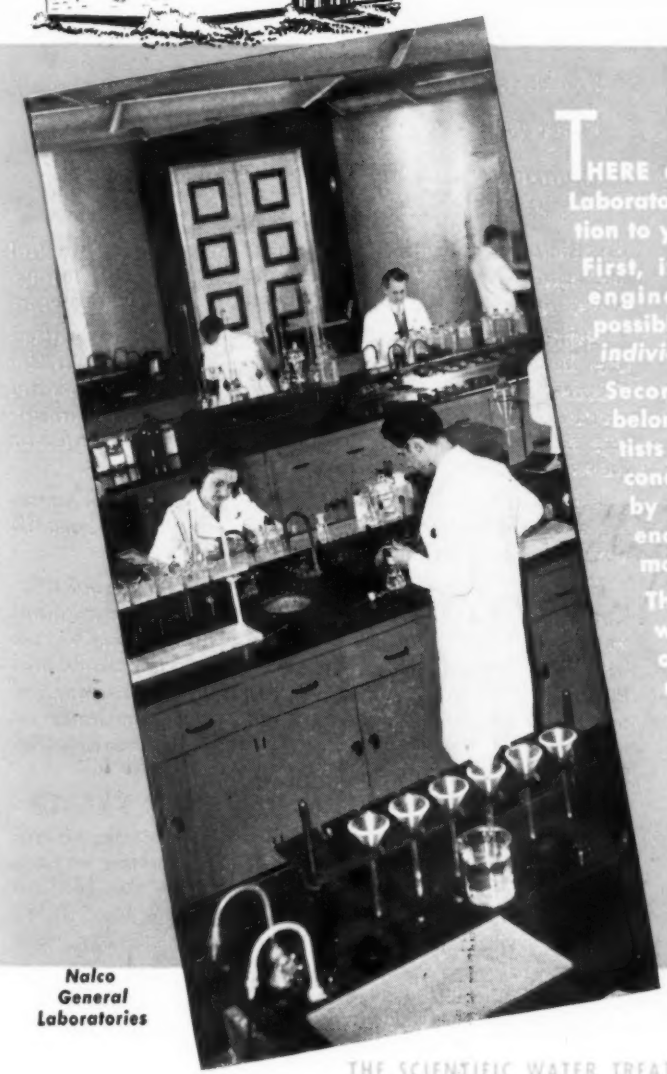
(*Continued on page* 138)

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P

This is really an addition to *your plant!*

says:

J. G. Clausen
Nalco Representative
Western New York State



Nalco General Laboratories

THERE are two reasons why we say that Nalco, its Laboratories and Service Organization, is really an addition to your plant:

First, it was conceived as a service to power plant engineers . . . the only means of getting the best possible water treatment information and action on an *individual plant basis.*

Second, on the theory that the Nalco Laboratories belong to practicing power plant engineers, the scientists and chemists who operate them are primarily concerned with the plant problems brought to them by Nalco Service Engineers . . . An interest that has enabled Nalco to contribute heavily to most successful modern water treatment practices.

Therefore, it is easy to see that the world's finest water treatment laboratories are, indeed, a part of your plant . . . Your facilities to use whenever necessary to get the best possible answer to your water treatment and control problems.

You are invited to put your Nalco Laboratories to work, now. Ask for a Nalco Survey that will give you a detailed picture of your present water treatment situation. Recommendations (if necessary) will be made to help you achieve the many advantages of complete scientific water treatment.

THE SCIENTIFIC WATER TREATMENT FOR ALL INDUSTRY

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place, Chicago 38, Illinois

Canadian inquiries should be addressed to
Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ont.

Nalco

How to plan a

HOT WATER RADIANT HEATING SYSTEM

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

Radiant Heating, although it is as old in principle as the sun, is comparatively new to industry. Its use has increased rapidly in the past few years, however, because of its high operating efficiency, and because it saves valuable floor and wall space in institutions, office buildings, hospitals, and garages.

Concealed in Walls, floors or ceilings, where it is inaccessible, it is obvious that the piping, and other equipment as well, must be carefully chosen to render long-life and trouble-free service. Thus, expensive charges for repairs and alterations – the usual objection to radiant heating – can be eliminated, or reduced to a cost comparable to maintenance of other types of heating systems. Properly installed, radiant heating serves economically and efficiently for many years.

Copper Tube, which is easily-bendable and made up with solder-ends, is the principal component of the system illustrated. Some engineers prefer to use the conventional screwed-end steel or iron pipe. Jenkins Valves for both types are listed in the diagram.

Hot Water is used in this typical low pressure, low temperature system, and is controlled by room and outdoor thermostats which in turn control 3-way mixing valves. Usually, one 3-way valve is installed for each main riser or zone under control of each thermostat. Drains are located at the heel of every riser and all low points to drain the system whenever necessary.

Globe Valves are recommended to permit maximum adjustment and control of flow, since perfect balancing by initial design is difficult. Water make-up is admitted manually and expansion is provided by an expansion tank fitted with an air cushion. Automatic air vents are located at high points and manually-controlled vents at other points. Circulation is maintained by pumps in duplicate installation. Because many codes do not yet approve copper tubing on supply connections, screw-end valves are shown for city water admission.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A **Use the right type valve for the service.**
B **Place valves correctly in the line.**
C **Choose Jenkins Valves for lifetime economy.**

13

FIG. 1200
Solder-End Bronze Globe Valve 300 lbs. Non-Shock Cold Water Pressure

Other types and pressure ranges of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when adapting these suggestions to your own requirements, or when planning any major piping installations.

Copies of Layout No. 13 will be furnished on request – also copies of future Piping Layouts. Just fill out and mail coupon.

Fig. 1200, the Jenkins Solder-End, Renewable-Composition-Disc Bronze Globe Valve recommended in this layout, is one pattern of several Jenkins Valves for copper lines. Its body casting is extra thick and strong, with heavy ends that will stand intense heat of soldering without danger of distorting the body or warping the seats. This extra strength assures trouble-free installation and performance.

A CHOICE OF OVER 600 JENKINS VALVES

To save time, to simplify planning, to get the advantage of Jenkins specialized valve-engineering experience – select all the valves you need from the Jenkins line, fully described in the Jenkins Catalog, No. 76. It's your best assurance of *the lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago; Jenkins Bros., Ltd., Montreal; London, England.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK

125 TO 600 LBS. STEAM PRESSURE

Jenkins Bros

HOT WATER RADIANT HEATING SYSTEM

Code	Quantity	Solder End	Screwed End	Service
A	1 per Panel	Fig. 1200 Br. Globe	Fig. 106-A	Panel Feed & Control
B	1 per Panel	Fig. 1200 Br. Globe	Fig. 106-A	Panel Return & Control
C	1 per Riser	Fig. 1200 Br. Globe	Fig. 106-A	Return Riser Shut-off & Control
D	2 per Riser	Fig. 1200 Br. Globe	Fig. 106-A	Feed Riser 3-Way By-Pass
E	1	Fig. 1200 Br. Globe	Fig. 106-A	Return to 3-Way Valve Control
F	1	Fig. 1200 Br. Globe	Fig. 106-A	Return to Heater Control
G	1	Fig. 1200 Br. Globe	Fig. 106-A	Expansion Tank Shut-off
H	2	Fig. 1200 Br. Globe	Fig. 106-A	Manual Air Vents
I	1 per Riser	Fig. 1200 Br. Globe	Fig. 106-A	Auto. Air Vent Shut-off
J	2	Fig. 1200 Br. Globe	Fig. 106-A	Pump Discharge Control
K	7	Fig. 1200 Br. Globe	Fig. 106-A	Drain Valves
L	3 per Riser	Fig. 1240 Br. Gate	Fig. 370	3-Way Valve Shut-off
M	1	Fig. 1240 Br. Gate	Fig. 370	Heater Feeder Main Shut-off
N	2	Fig. 1240 Br. Gate	Fig. 370	Pump Suction Shut-off
O	2	Fig. 1222 Br. Check	Fig. 92	Pump Discharge Checks
P	1	Fig. 106-A Br. Globe		Water Make-up
Q	1	Fig. 117-A Br. Check		Water Make-up

VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog

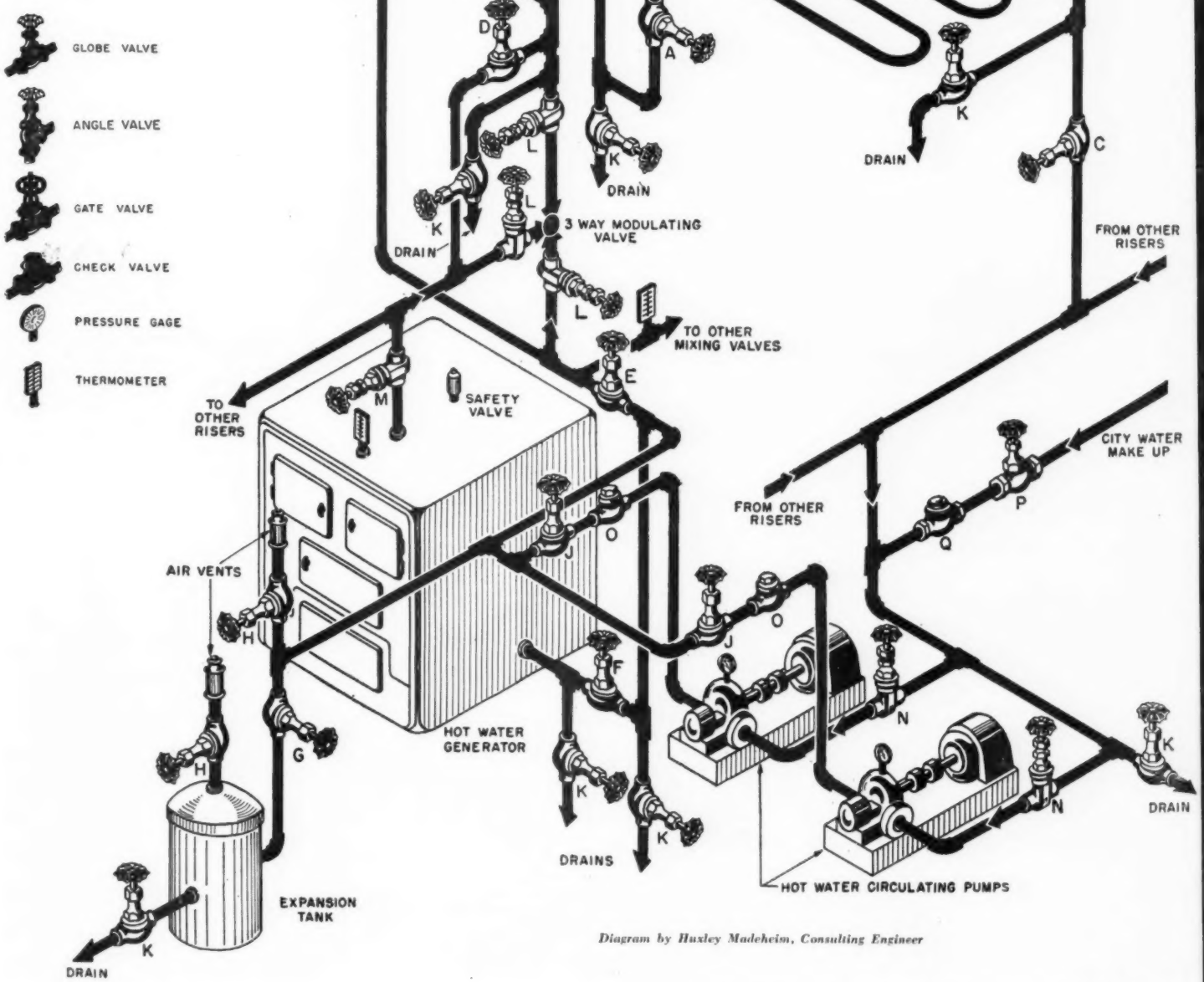


Diagram by Huxley Madeheim, Consulting Engineer

BRONZE ★ IRON ★ STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS BROS., 80 White St., New York 13, N. Y.

Please send me a reprint of Piping Layout No. 13 and future Layouts as they become available.

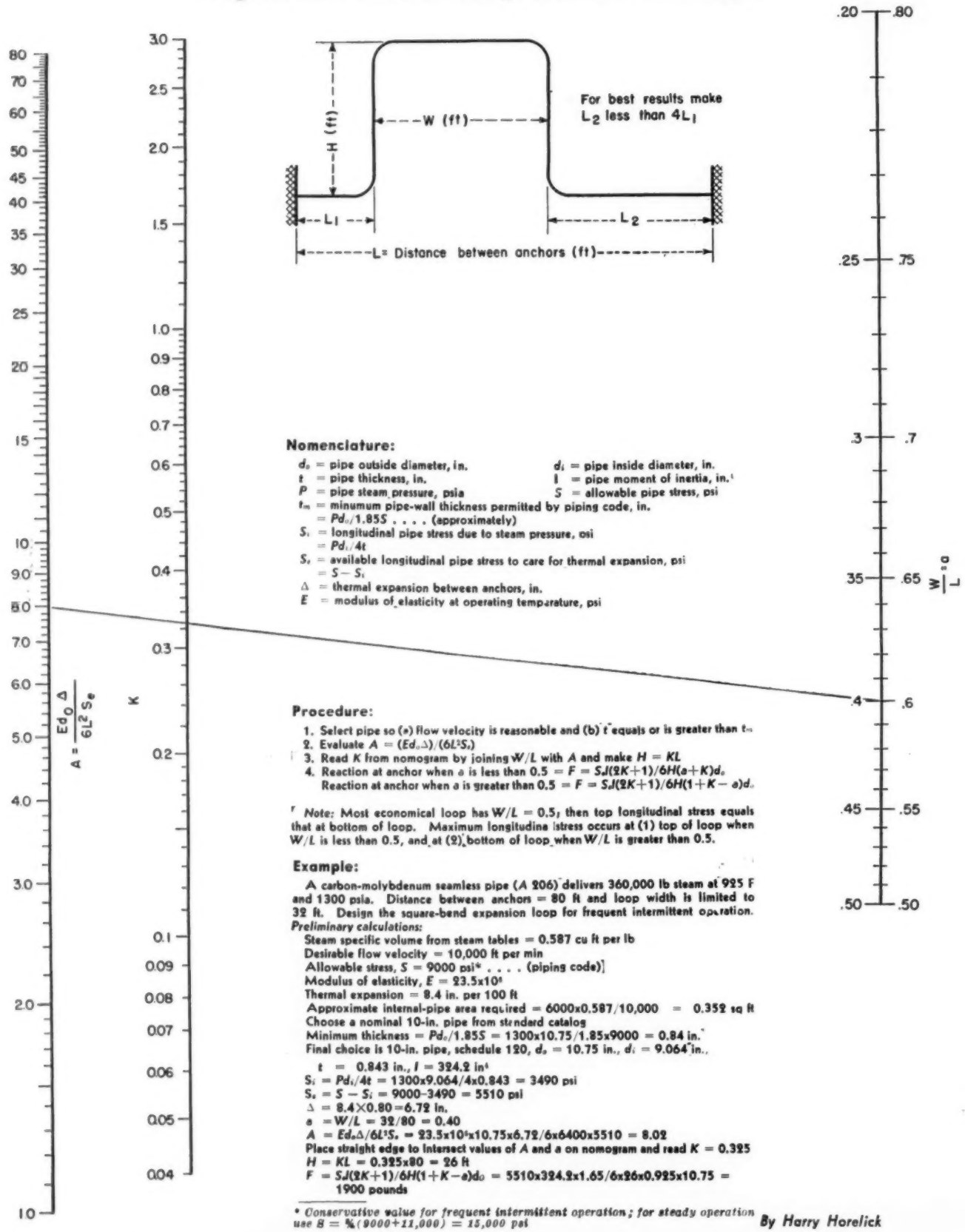
Name .....

Company .....

Address .....

Number 168

Square-Bend Expansion Loop



Nomenclature:

d_o = pipe outside diameter, in.
d_i = pipe inside diameter, in.
t = pipe thickness, in.
I = pipe moment of inertia, in.⁴
P = pipe steam pressure, psia
S = allowable pipe stress, psi
t_m = minumum pipe-wall thickness permitted by piping code, in.
= $Pd_o/1.85S$ . . . . (approximately)
S_i = longitudinal pipe stress due to steam pressure, psi
= $Pd_i/4t$
S_e = available longitudinal pipe stress to care for thermal expansion, psi
= $S - S_i$
Δ = thermal expansion between anchors, in.
E = modulus of elasticity at operating temperature, psi

Procedure:

1. Select pipe so (a) flow velocity is reasonable and (b) t equals or is greater than t_m
2. Evaluate $A = (Ed_o\Delta)/(6L^2S_e)$
3. Read K from nomogram by joining W/L with A and make $H = KL$
4. Reaction at anchor when a is less than 0.5 = $F = SI(2K+1)/6H(a+K)d_o$
   Reaction at anchor when a is greater than 0.5 = $F = SI(2K+1)/6H(1+K-a)d_o$

† *Note:* Most economical loop has $W/L = 0.5$; then top longitudinal stress equals that at bottom of loop. Maximum longitudina stress occurs at (1) top of loop when W/L is less than 0.5, and at (2) bottom of loop when W/L is greater than 0.5.

Example:

A carbon-molybdenum seamless pipe (A 206) delivers 360,000 lb steam at 925 F and 1300 psia. Distance between anchors = 80 ft and loop width is limited to 32 ft. Design the square-bend expansion loop for frequent intermittent operation.

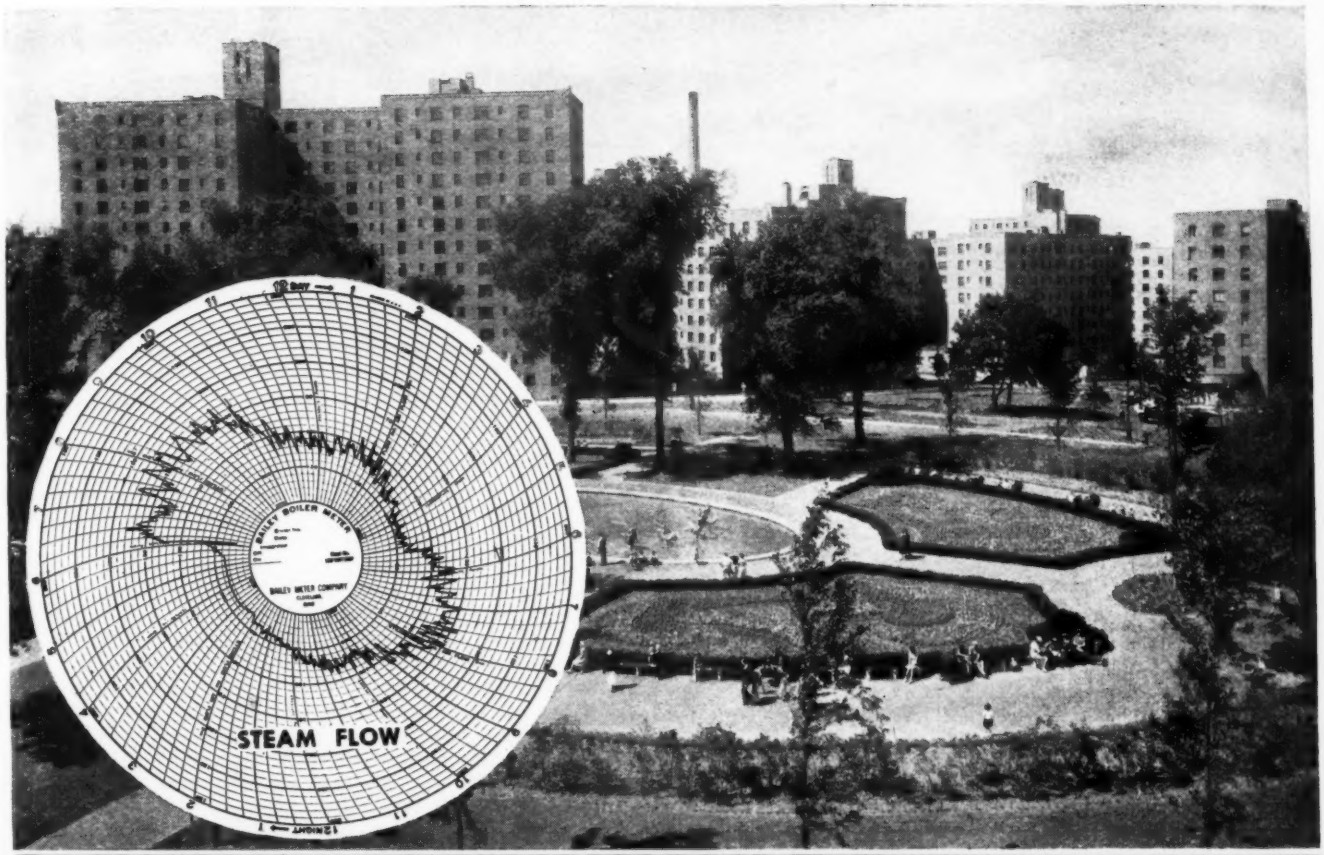
Preliminary calculations:

Steam specific volume from steam tables = 0.587 cu ft per lb
Desirable flow velocity = 10,000 ft per min
Allowable stress, S = 9000 psi* . . . . (piping code)
Modulus of elasticity, $E = 23.5 \times 10^6$
Thermal expansion = 8.4 in. per 100 ft
Approximate internal-pipe area required = 6000x0.587/10,000 = 0.352 sq ft
Choose a nominal 10-in. pipe from standard catalog
Minimum thickness = $Pd_o/1.85S$ = 1300x10.75/1.85x9000 = 0.84 in.
Final choice is 10-in. pipe, schedule 120, d_o = 10.75 in., d_i = 9.064 in.,
t = 0.843 in., I = 324.2 in⁴
$S_i = Pd_i/4t$ = 1300x9.064/4x0.843 = 3490 psi
$S_e = S - S_i$ = 9000–3490 = 5510 psi
Δ = 8.4×0.80 = 6.72 in.
$a = W/L$ = 32/80 = 0.40
$A = Ed_o\Delta/6L^2S_e$ = 23.5x10⁶x10.75x6.72/6x6400x5510 = 8.02
Place straight edge to intersect values of A and a on nomogram and read K = 0.325
$H = KL$ = 0.325x80 = 26 ft
$F = SI(2K+1)/6H(1+K-a)d_o$ = 5510x324.2x1.65/6x26x0.925x10.75 = 1900 pounds

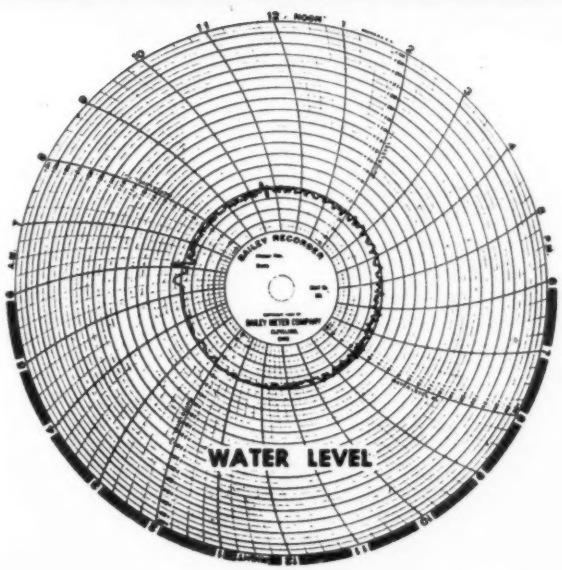
* *Conservative value for frequent intermittent operation; for steady operation use* $S = \frac{5}{6}(9000+11,000) = 15,000$ *psi*

By Harry Horelick

© POWER



COPES AT PARKCHESTER



COPES is maintaining a closely-stabilized boiler water level (recorder chart) for the fluctuating loads (boiler meter chart) on the Foster Wheeler boilers in the central heating plant at Parkchester—far-famed housing project of Metropolitan Life Insurance Company.

The story behind this city within a city, its heating system and the boiler water level control is told in an interesting new COPES performance report—Bulletin 451. Write—company letterhead, please—for a copy.

NORTHERN EQUIPMENT COMPANY
861 GROVE DRIVE, ERIE, PENNSYLVANIA
Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters
BRANCH PLANTS: Canada, England, France
Representatives Everywhere

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR
FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

Better Housekeeping . . .

Smoke is messy, unsightly, unhealthy, a general all-round nuisance, and expensive. Where there's too much smoke, you'll find equipment too old to carry the load, or improperly installed, or inefficiently used —and whatever the cause, it represents dollars being wasted. That's why the *Coal Producers Committee for Smoke Abatement* deserves real credit for its attempt to solve the problem in a sensible way.

Some 2200 plants have been surveyed by this group, to determine causes of smoke and methods of abatement, and the evidence on 687 boilers, in moderate- and smaller-sized plants, is astonishing. Of all the installations studied, only 8% were judged to be in first-class operating condition, and were being fired correctly. Fifteen percent had only minor defects and were being operated satisfactorily. More than two thirds had operational difficulties, caused by these inadequacies:

Incorrect firing. This was the primary reason for smoke and inefficient operation. Contributory causes included firing by no particular method, overloading of the firebox, trying to force a cold boiler, poor maintenance, and allowing accumulations of soot and fly-ash. The answer here is pretty obvious—better housekeeping.

Draft leaks. About 5% of the plants studied had leaks in the breeching or in the chimney, or had breechings with unnecessary turns and restrictions.

Poor draft conditions. Quite a few had overloaded stacks, or failed to keep stacks in step with added boilers. Increased stack capacity, or installation of induced-draft fans, would solve this problem.

Inability to see smoke. Only 15 installations were found to have smoke alarm systems, and in only 16 was it possible for operating personnel to see readily the tops of stacks. The necessity for having a smoke alarm or mirror arrangement is apparent.

Poor scheduling of duties. It was found to be an almost universal practice to burden boiler-operating personnel with other duties, so that not enough time remained to care properly for the steam plant. The Committee report concluded that competent supervision and intelligent planning can save from 10% to 25% of the coal bill, in addition to reducing smoke.

Improper use of boiler accessories. Many of the plants inspected, particularly those ranging from installed boiler hp of 75 or more, were equipped with draft gages, flowmeters, and combustion controls. It was found that not more than 25% of this equipment was being operated properly. More than half of the draft gages could not be read or were not even connected to the boilers. Many flowmeters tested did not return to zero, or were sluggish. Usually, CO_2 recorders were either not in operation, or not working correctly. All of this would be ridiculous if it were not so tragic.

The time is not far off when fouling the air we all breathe will be as much of an offense as throwing garbage on the front lawn, and there is about the same lack of excuse. With the equipment available today, and good operating methods being made known to all, excessive smoke is without apology. Let's, then, be better housekeepers, and show the way in smoke abatement, for we'll contribute to civic betterment and gain financial advantage at the same time.

George Edwards
Engineer

The Stuffing Box

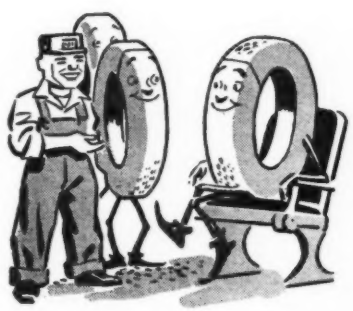
TIPS ON GOOD PACKING PRACTICE

NO. 3 OF A SERIES

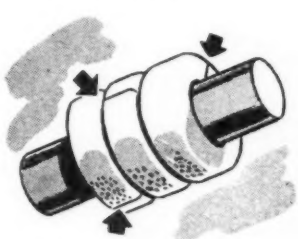
Previous issues of "The Stuffing Box" have included pointers on inspection and tips on preparing the new packing for installation. Now we're ready to go ahead with the actual re-packing job.

(**Note:** If you missed Numbers 1 and 2 in the Stuffing Box series, write today to Johns-Manville for free copies—see address below.)

Here are three simple rules that will help make any packing job last longer:



1. Seat each packing ring carefully before placing the next one in the box. Avoid loading the box with packing and then pulling up on the gland follower. This practice often results in jamming and deforming the last rings inserted and building up excessive gland pressure on these rings. There is also the danger that the bottom rings may not be seated properly.



2. Install the rings so that the joints are staggered and kept approximately 90 deg. apart. Thus each joint is sealed by the packing ring next to it.

3. Pull up the gland follower sufficiently tight to insure final seating of the packing. To make sure the gland isn't cocked, tighten the nuts alternately, first on one side, then on the other. Then slacken off and leave them finger-tight. Further adjustments should be made after the pump has been in operation.

Let the packing leak a little if possible. It is good assurance that the packing is not too tight, and the liquid usually has some lubricating qualities. If leaking can't be permitted, arrange to introduce a sealing or lubricating fluid into the stuffing box as recommended by many pump manufacturers. Water, oil or grease will do the trick.

Think of the stuffing box as a potential brake assembly that may develop considerable frictional resistance. Pressure, times velocity in feet per minute, times coefficient of friction, is a rule of thumb measure of the energy absorbed. Use lubrication to minimize friction.

Finally, keep the packing clean, before, during and after the re-packing job. Wrap up any extra rings and place them in their container so they won't pick up grit or other foreign matter that might score when it comes into contact with a shaft or rod.

And next time you need a packing, remember there are 400 conveniently located Johns-Manville Distributors throughout the country ready to supply the right one for your job.

It's good practice to use Johns-Manville

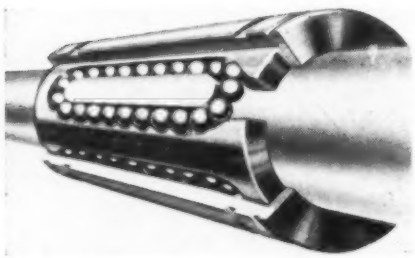
KEARSARGE ROD PACKING

When you need a long-wearing rod and plunger packing for service up to 500° F., use Kearsarge. Its unique folded construction forms a reservoir for the preserving lubricant, keeps this packing pliable in service and makes it last longer. Kearsarge is especially recommended for use on reciprocating rods of steam engines, pumps, compressors, etc., where the packing space is ⅛" or more. It may also be used against air and gas. See your distributor, or write Johns-Manville, Box 290, New York 16, N. Y.

EQUIPMENT *Continued*

this method of analysis varies from 0.01 to 1.00%, depending upon difference in atomic numbers of components making up the specimens.

All controls are available from front of cabinet. Provision is made for several kinds of test cells, in which the samples are contained, and liquid and gas cells can be arranged for continuous flow of materials being analyzed. No special skill is required to operate the analyzer and analysis is independent of temperature or pressure for solids and liquids. **Dept P, General Electric Co, Schenectady, N. Y.**

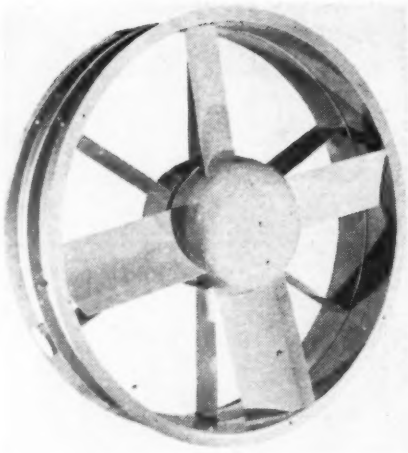


Ball Bushing

FREE-ROLLING BALL BUSHING does not need great length to diameter ratio to prevent cocking and binding. Size, weight and cost of mechanisms can be scaled down by application of this ball bushing. Standard ball bushing sizes vary from ¼-in. shaft size to 4 in. Sizes from ¼- to 1-in. vary in ⅛-in. steps, from 1 to 3 in. in ¼-in. steps and from 3 to 4 in. in ½-in. steps. Production of some of the smaller sizes is now under way. Volume production of remaining sizes will be started soon. Standardization of ball bushing for square shafts is not yet complete but this design may be furnished on an experimental basis for prototype equipment. Actual production is scheduled for later this year. **Dept P, Thomson Industries, Inc, 29-05 Review Ave, Long Island City 1, N. Y.**

Alkyd Resin

ARCHITECTURAL WHITE ALKYD ENAMELS, which exhibit outstanding color and gloss retention combined with materially improved brushing qualities, are now possible through development of a new alkyd resin, *Duraplex D-65*. This new phthalic alkyd possesses inherent gloss and therefore requires no added resins or varnishes with consequent darkening of color. Among other features of *Duraplex D-65* are its excellent pigment stability and desirable drying properties. The physical constants of *Duraplex D-65* are as follows: Solids—70%; acid number—8 max; gravity—0.96; viscosity—C-F (50% in M T); color—5-8. **Dept P, Resinous Products and Chemical Co, Philadelphia.**



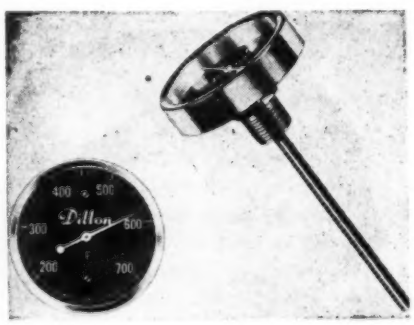
Corrosion-Resistant Fan

MADE IN 3- TO 5-FT DIA, corrosion-resistant fan of monel metal is for damp or corrosive vapors, or of cold-rolled steel for ordinary exhaust ventilation and cooling. Fan is an axial-flow ventilating model. A special high-slip slow-speed direct-drive motor, equipped with permanently greased and sealed bearings, makes it possible to mount fan in any position.

Motor is an 18-pole 375-rpm 220-v single-phase model, or 220- to 440-v 3-phase, with an input of 700 watts. Motor is internally cooled by circulating air within hub of fan without drawing in outside air that might be contaminated. Guide vanes on inlet side of fan reduce tendency of air to corkscrew with rotation of blades. Blade tips revolve with a ring that reduces tip losses. Large hub eliminates that portion of blade that has a low peripheral speed and thereby voids possibility of a backflow of air through center of fan. Fan shown is of ventilating design for free air delivery. **Dept P, Moore Co, 544 Westport Rd, Kansas City 2, Missouri.**

Stainless-Steel Thermometer

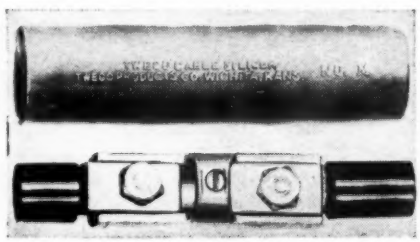
THERMOMETER HAS AN 18-8 stainless-steel stem and mounting nut. It is resistant to all but a few acids. Pointer is fixed to stainless-steel shaft, the shaft directly to coil. It has no gears. Overload accuracy is unaffected up to 50% above 500-F range, according to maker, and 10% above 750-F range. Stem is immersed in 2 in. of liquid or 4 in. of gas.



Dial sizes are 3 and 5 in. standard. Stem is ¼ in. dia, 5 or 9 in. long. Special length stems are available on order. Special wells are available for use where extremely high pressures are encountered or where it is necessary to remove thermometer from time to time. **Dept P, W C Dillon & Co, 5410 W Harrison St, Chicago 44, Ill.**

Pneumatic Transmitter

LINE OF PNEUMATIC transmitting accessories may be applied to any *Rotameter* flow-rate instrument. Transmitter consists of a unique indissoluble magnetic clutch which picks up *Rotameter* float movement and translates it into external angular motion. Attached to magnetic follower beam is a newly designed air pilot with a linear pressure output characteristic. *Rotameter* readings may be transmitted at great distances to recorders, indicators or recorder-controllers equipped with pressure-bellows pneumatic actuating motors. This accessory for *Rotameters* eliminates need for electrical-transmission means and is being applied in locations where explosive volatile gases are present. **Dept 6G-3, Fischer & Porter Co, Hatboro, Pa.**



Cable Splicer

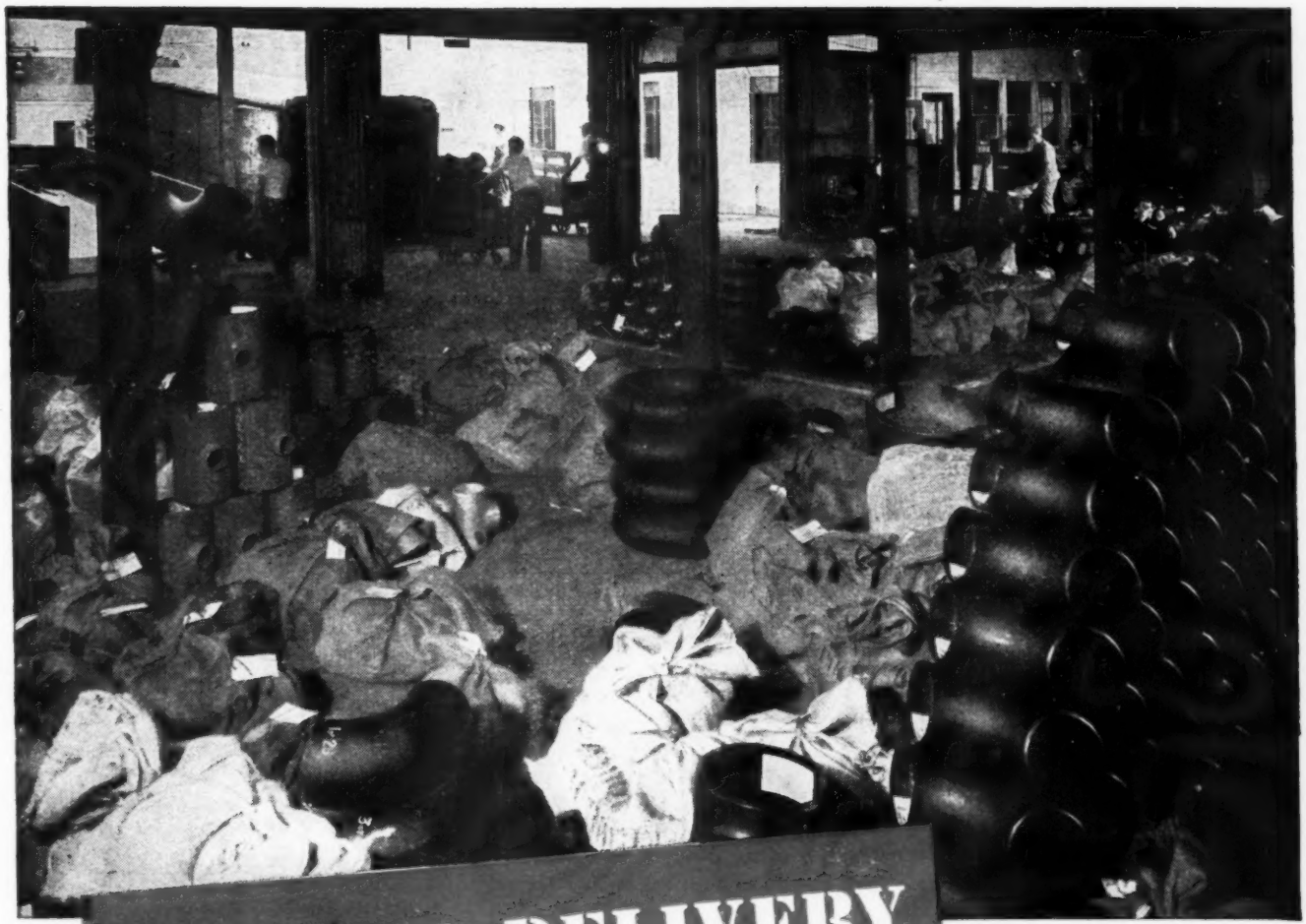
TWECO CABLE SPLICERS provide a quick repair of broken cables or salvaging short lengths. Clamp cable connection on each end of splicer, with provision to solder between cable ends, assures an efficient connection. Fiber sleeve covers this easily installed cable splicer. It is made in three sizes to cover full range of welding cables: Size *S* for small No. 4, 2 or 1 cables; Size *M* for medium No. 1/0 or 2/0 cables; Size *L* for large 3/0 and 4/0 cables. **Dept P, Tweco Products Co, English at Ida, Wichita 7, Kan.**

Pressure Gage

INSTRUMENT IS A HEAVY-DUTY pressure gage for severe industrial service. Internal parts are of noncorrosive metals. Working elements are designed to withstand repeated pulsation and vibration as well as abnormally high overpressures. *Supergauge* may be read at great distance as a result of basic

(*Continued on page* 160)

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P



SPECIAL DELIVERY

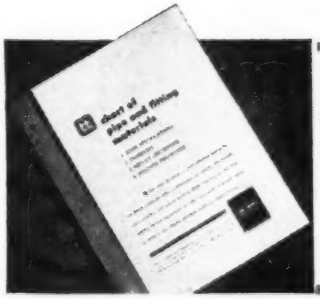
From YOUR Tube Turns Distributor

FAST delivery of Tube-Turn welding fittings is assured, even in these days, because a carefully selected, well-stocked Tube Turns distributor who knows local conditions and requirements is located near every industrial activity throughout the United States. When you call on *your* nearby Tube Turns distributor, you benefit from his experience plus extra technical help from expert district office men and the engineering staff of Tube Turns' headquarters at Louisville, Kentucky.

To get the finest fittings fastest, ask us today for the name of *your* Tube Turns distributor. If you do not own a copy of Tube Turns' famous Catalog 111, he will be happy to supply it. Write, phone or wire, NOW!

TUBE-TURN TRADE MARK **tt** *Welding Fittings and Flanges*

PIPING PERMANENCE SINCE 1927



TUBE TURNS (INC.), LOUISVILLE 1, KENTUCKY

Please send new Tube Turns chart of pipe and fitting materials, showing grade and standard type numbers, ASTM specifications, and chemistry and service limitations, plus description of welding procedures, including rod, preheat and stress relieving.

NAME..... COMPANY.....

POSITION..... STREET.....

ZONE.....CITY..... STATE.....

2708

THE ARGUMENT CORNER

WHAT'S WRONG WITH THIS ENGINE? Plenty, but it can be repaired, says S C Page in his advice to a *Power* reader

GEORGE EDWARDS DRAWS FIRE. L L Scheiderer says heaven-born fish are no myth; J C. Runyon reports on advantages of storing coal in the family bathtub on frosty mornings

What's Wrong With This Engine?

THE INDICATOR CARDS in Fig. 1 are taken from the engine described in Q 1, Jan 1946, Reader's Problems, which is a 150-rpm 400-hp tandem-compound unit with 15½ and 26x27-in. cylinders, using 160-psig steam. A 6-in. steam line feeds the engine; a 7-in. pipe serves as receiver and a 9-in. pipe exhausts to condenser.

Loss of pressure between cylinders is a good example of the detrimental effect of water and dirty steam passing through an engine.

The h-p to l-p cylinder volume ratio of 1 to 2.82 indicates the unit was designed for noncondensing operation. Fig. 2, page 142, shows an engine designed for this kind of service. Although the condenser improves efficiency and increases available output, the over-all efficiency is considerably lower than would be attained if cylinder ratio were 1 to 4, which is the accepted practice for condensing operation.

ENGINE ANALYZED

Referring to the 120-rpm h-p cards, Fig. 1, the right diagram is higher than the left. This may be caused by leakage in exhaust valve. As speed decreases, the difference increases because of longer leakage period. L-p straight compression lines are a further indication of leakage. Part of exhaust-valve leakage is hidden by the inlet-valve leakage, which tends to overcome some of the effect.

The unusual dip in the exhaust lines can only be caused by a drop in receiver pressure. Only place steam can escape is through the l-p cylinder to condenser. Therefore exhaust steam from h-p cylinder is blowing through l-p valves or by the piston. Quick recovery of the receiver pressure, shown at the end of the dip in the exhaust line, indicates considerable leakage through h-p cylinder. From appearance of exhaust lines, indications are that both inlet and exhaust valves of the l-p cylinder are open at the same time.

The trap mentioned drains only a small percent of the condensation from receiver because steam travels so fast it carries water directly into the l-p cylinder. This water washes away cylinder lubrication, producing an abnormal rate of wear.

With 20-psia receiver pressure and 2½-psia exhaust pressure, which makes about 17½-psia receiver pressure, this engine would produce a mep of about 5 psia on the l-p cylinder, the equivalent of about 35 ihp at 120 rpm. Therefore, because of the poor mechanical condition, little work is being derived from steam passing through the l-p cylinder.

L-p cards show the valve gear is so badly out of adjustment that a complete overhaul is necessary. There is no apparent point of cutoff and the admission is late. There is no compression on the 120-rpm card shown for the l-p cylinder.

This discussion would seem incomplete without some suggestion for suitable corrective measures. Valve gear and governing mechanism should be repaired and valves reconditioned to make them steamtight. Valve setting diagrams, Fig. 3, are the type often used in shops on new engines. They can be used for setting valves on this engine.

Adjust Valves. Tram the engine and lay out dead centers on the face of the flywheel, guides and crosshead. Lay out opening and closing points of the valves on the guides and place a corresponding mark on the crosshead near its center. Scale of stroke in the diagram gives the position of layout marks on the guide. Bar engine over and set valves to open and close at designated points. Check governor so engine cannot overspeed.

Run the engine and take a set of

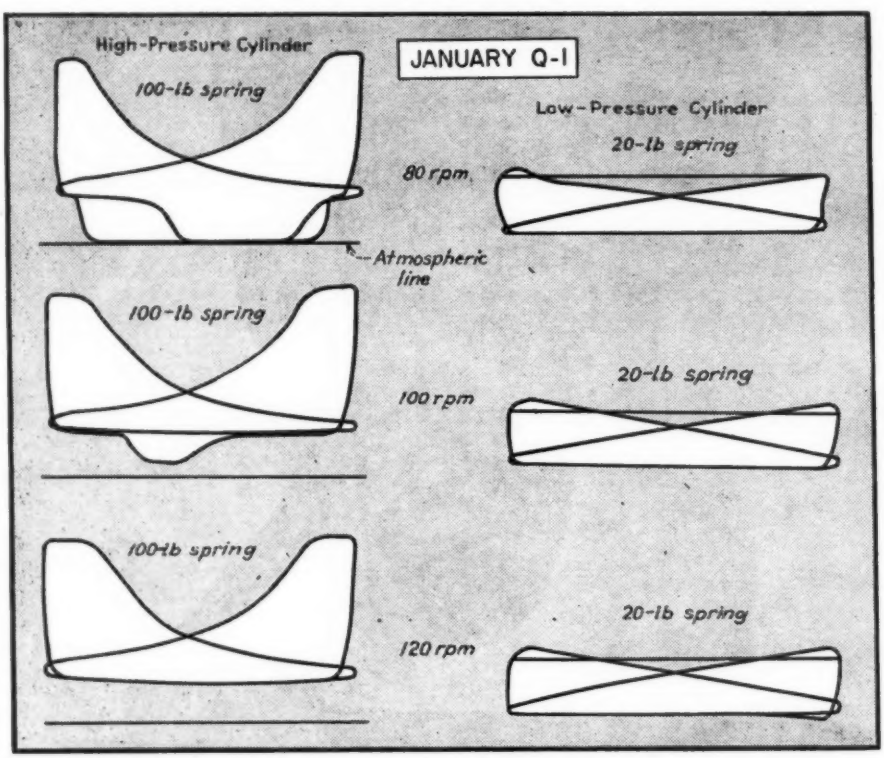


Fig. 1—Indicator cards for h-p and l-p cylinders, tandem-compound steam engine. Dips in exhaust line show incorrect operation and power loss between the cylinders

STOP THE SLAMMING

and you'll cut maintenance costs!

CHAPMAN CHECK VALVES

TILTING DISK

Slamming jars pipelines, starts surging and opens up joints, thus necessitating high maintenance costs. The Chapman Tilting Disc Check Valve employs a balanced hinge-pinned disc which rides evenly in the flow when the valve is open and cushions quietly to a drop-tight seat when the flow slows down.

Experience has proved that Chapman Tilting Disc Check Valves invariably save from 65% to 80% in head losses over conventional type check valves.

Chapman Tilting Disc Check Valves are made in iron and steel.

Send for free engineering data and reports of tests.

The Chapman Valve Manufacturing Company

INDIAN ORCHARD, MASSACHUSETTS

indicator cards to check results. Regulate the point of cutoff on l-p cylinder to give the shortest possible cutoff on h-p cylinder. This is point of best steam economy and will likely give 35- to 40-psig receiver pressure. When the receiver pressure is established, adjust exhaust valves to carry 80% of total required compression on h-p and 20% on l-p cylinders. This can be determined by taking indicator cards. Compression on the h-p cylinder will be 80 psig and on the l-p cylinder, 9½ psig. Both the capacity and the steam economy of the unit will be improved. If cards still show serious leakage, it will be in the pistons, and refitting can be done as a separate operation.

Separator Causes Trouble. Measure the steam separator; if its volume is less than 12 cu ft or four times the volume of h-p cylinders, replace it with a larger one. Inspect baffles; they may have holes worn through them or be of such design as to have little value for cleaning the steam.

Even with low boiler-water concentration, there is sure to be some carry-over to the superheater. Here the solids dry, forming crystals of abrasive dust that carries along with the steam entering the cylinder, unless arrested. This is the cause of most lubrication difficulties where superheated steam is employed, and also accounts for about 90% of cylinder and valve wear. Separator baffles must arrest this material to be effective.

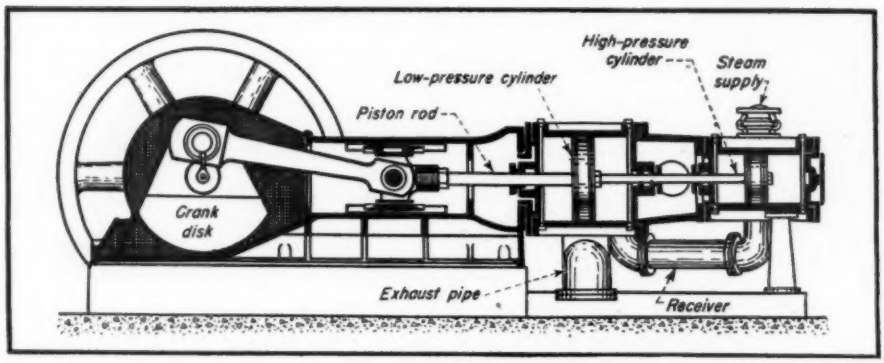


Fig. 2—Typical tandem-compound engine shows the small size of receiver between the h-p and l-p cylinders. The sizes of cylinders are for noncondensing operation

The receiver serves as a separator for the l-p cylinder. It reduces velocity of the exhaust steam from h-p cylinder so water can separate from the steam. In addition to removing oil and water, any abrasive material, worn from or passing through h-p cylinder, is arrested and removed with water and oil through the trap. This prolongs the life and materially reduces lubrication requirement of the l-p cylinder.

I know a plant where six tandem-compound engines like Fig. 2 are in operation, three without and three with receivers of ample volume. After a few years' operation, the engines without receivers were in the same condition as the engine described in this problem.

The engines equipped with receivers were in very good condition after a longer period of service and needed no major repairs. One unit is of interest. It is equipped with an excellent steam separator and a reheating receiver five times the volume of the l-p cylinder. The reheating coil carries boiler pressure at 175 psig and is of sufficient capacity to re-evaporate all the condensate from the h-p cylinder. Complete inspection of this unit revealed all working parts in perfect condition after 20 years of nearly constant service.

Buffalo, N. Y. SCHUYLER C PAGE

(*Continued on page* 150)

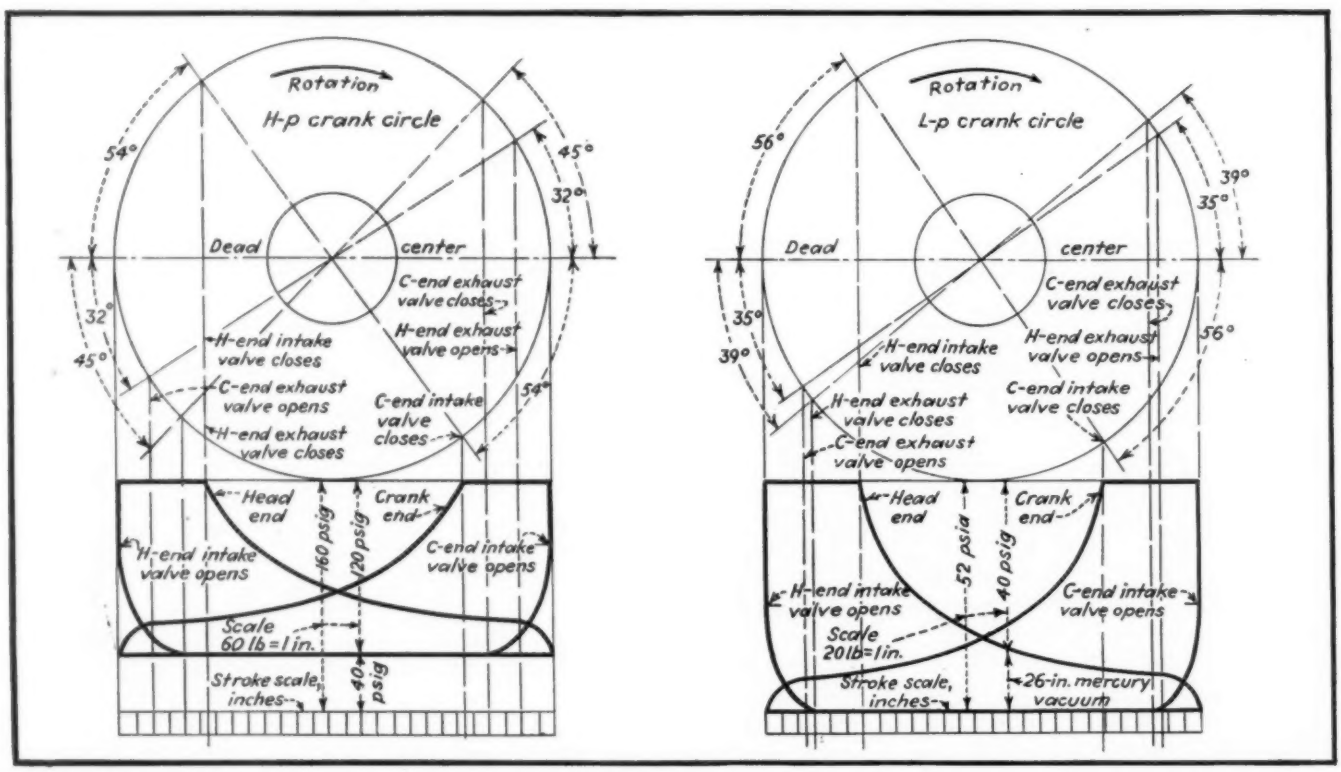
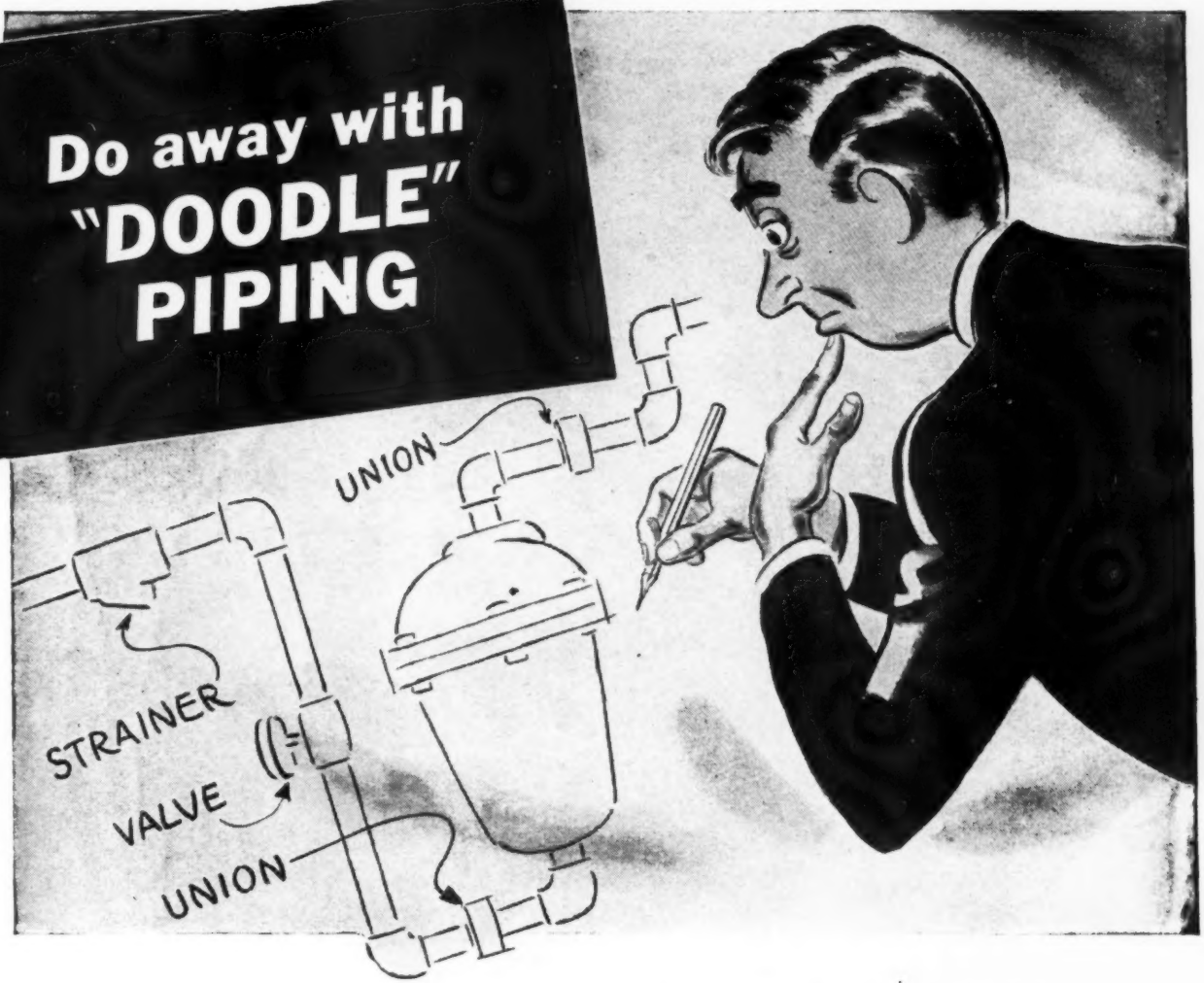


Fig. 3—Valve-setting diagrams, used in shops for new engines, can also set valves in the field on tandem-compound engine in this problem. Locate opening and closing points of valves on diagram accurately on engine's stroke scale

Do away with "DOODLE" PIPING



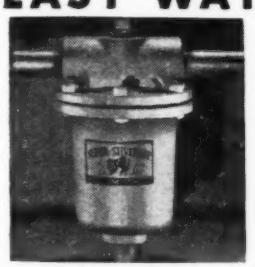
By today's standards, steam trap piping is wasteful if it looks like scratch-pad doodling. Earlier designs of inverted bucket traps left no choice but "doodle" piping—in at the bottom and out at the top.

But . . . Anderson Super-Silvertop has the pipe connections in the head of the trap, permitting *BOTH* elbow and straight-in-line piping with only one fitting. This common sense improvement not only gives reduced installation costs without resorting to split (pierced) gasket or cored passages, but—in addition, the guided bucket results in increased capacity for the same size of trap.

Simplify your piping with Super-Silvertop. You save in first cost, on installation costs and ease of inspection, besides the satisfaction of clean-cut, neat piping layouts. Have you sent for your free copy of the book, "How To Choose A Steam Trap"? It is written to help you and is now helping others. Write for your copy today.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • • Cleveland 2, Ohio

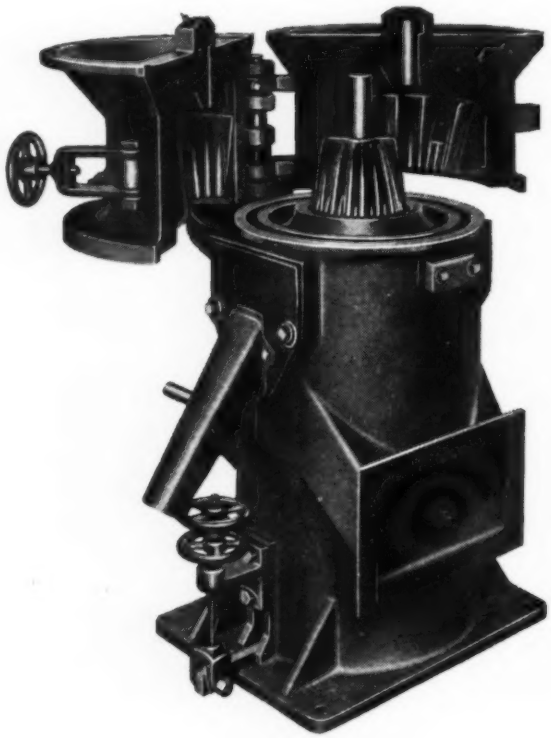
Do it the EASY WAY



STRAIGHT- IN-LINE

AS AN ELBOW

SUPER-SILVERTOP STEAM TRAP



Sample 1 Ton of Coal in 1 Hour Automatically with

STURTEVANT
COAL SAMPLERS

★ **Speed Sampling by Eliminating 32 Hand Operations**

★ **Provide Accurate Representative Samples in a Few Minutes**

★ **Quickly Pay for Themselves Out of Savings**

There is no need to guess about the BTU value of coal . . . not when you can get accurate samples in a few minutes with the Sturtevant Automatic Coal Sampler.

Here's how it works . . . coal is fed into the sampler where it is reduced, crushed and mixed automatically so that it is truly representative of any given lot. The resulting analysis gives a true picture of the coal avoiding any possibility of misunderstanding between the supplier and user of the coal.

Write for bulletin and full information today.

STURTEVANT
MILL COMPANY
33 HARRISON SQUARE, BOSTON 22, MASSACHUSETTS

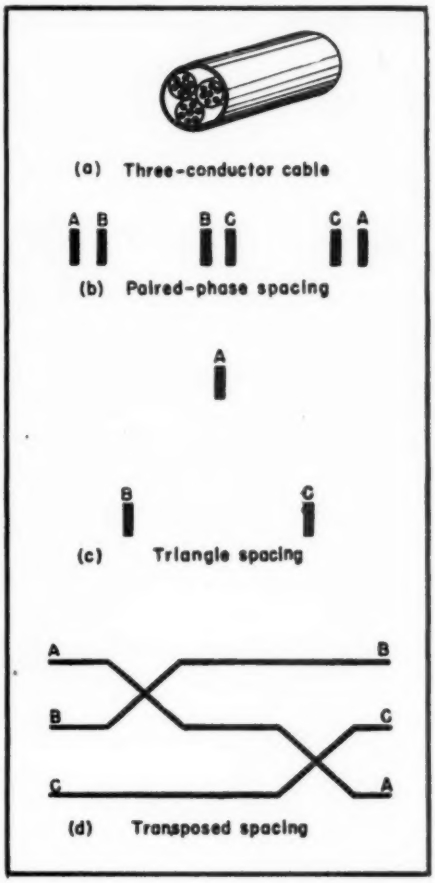
Designers and Manufacturers of
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

Busbar Spacing

(*Continued from page* 100)

could then be operated at full load without overheating.

Conductor spacing can be arranged during installation or design of low-voltage systems to eliminate unbalanced reactance by one of four methods shown in the diagram: (1) multiple 3-conductor cables.



as in (*a*) for long runs without taps; (2) paired-phase bus arrangement as at (*b*); (3) triangular spacing at (*c*); and (4) bus conductors transposed as at (*d*) to cancel unbalanced currents.

Roller Bearings

(*Continued from page* 76)

cage has a pair of end plates with rigidly connected bars between them.

Fig. 25 shows the parts of a journal spiral-roller bearing. Rollers are made from a rectangular steel strip wound into a helix to form a roller. Cage consists of two end rings connected with a set of stay rods. When the rods pass between

PRECISE CONTROL
OF WELDING PROCEDURES

AVAILABLE ONLY THROUGH MODERN SHOP FABRICATION

PRECISE welding control is a major reason why shop fabrication by Pittsburgh Piping and Equipment Company results in a thoroughly dependable piping installation.

The illustration shows how a welding operation on 14" high pressure, high temperature piping is performed. The area adjacent to the weld is induction preheated to a temperature of 500°F. min. This temperature is accurately maintained during the entire electric arc-welding operation by means of indicating and control instruments. When the weld is finished, stress-relieving is accomplished by similar procedure.

Better welding contributes to the safer, more satisfactory prefabricated piping installations produced by Pittsburgh Piping and Equipment Company.

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
634 S. Gramercy Place, Los Angeles
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
Whitehead Building, Atlanta

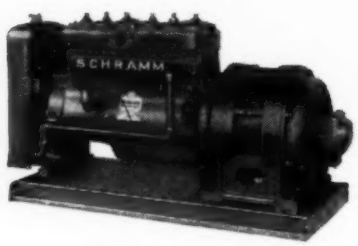
Do You Need **DIRECT DRIVE ON BASE?**

Built-in Motor Drive mounted on steel base is compact and easy to install. No foundations necessary.

Do You Need

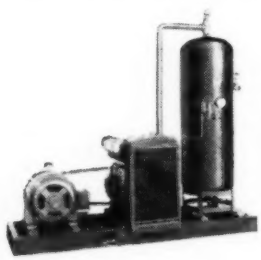
DIRECT MOTOR DRIVE WITH COOLING UNIT?

Schramm 300 cu. ft. displacement with direct-connected 50 H.P. motor with cooling unit on Steel Deck Base.



Or— **BELT DRIVE WITH TANK AND COOLING UNIT**

mounted and ready for immediate installation? Belt Drive complete with motor, vertical air receiver and cooling unit all mounted on a single base.



SCHRAMM offers you a complete line of Air Compressors for your every need! Sizes range up to 600 cu. ft. displacement! Schramm's stationary units are widely used in plants throughout the country, and are specified because they are vibrationless, lightweight, compact . . . and at the same time easily furnish a steady flow of air. Write today for full details on Schramm Air Compressors.

SCHRAMM INC

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

the rollers the assembly is called a bar-between type and when the rods pass through the spiral roller's center it is a bar-through assembly.

Fig. 25 shows the component parts for a solid-roller assembly. Solid rollers are made with trunnion ends, which fit into holes in the end rings to keep them in place. The assembly is held together by the bar-between method in which the rods pass between the rollers. It is not necessary to have a rod between each pair of rollers, and bearings are sometimes arranged with the rods passing between groups of rollers.

SOLID OUTER RACES

In Fig. 27 the solid outer race is a hardened and ground cylinder. Oil holes are usually provided in it to facilitate lubrication. The outer race, Fig. 28, is split its entire length. It is made of a planished steel-strip rolled to shape with either soft or cyanided glass-hard finish. Its open joint with an outward spring forms a vee so the rollers pass over it without shock or noise. Pressing the race into its housing closes the joint, so outward tension holds one in the other.

Space limits prevent describing all journal-roller bearings; heavy-duty designs made with metric bores and outside diameters are a popular series. They have solid inner and outer races and usually have spiral rollers although some sizes have also solid rollers. Fig. 29 shows construction of a heavy-duty journal-roller bearing with spiral rollers and an inner race.

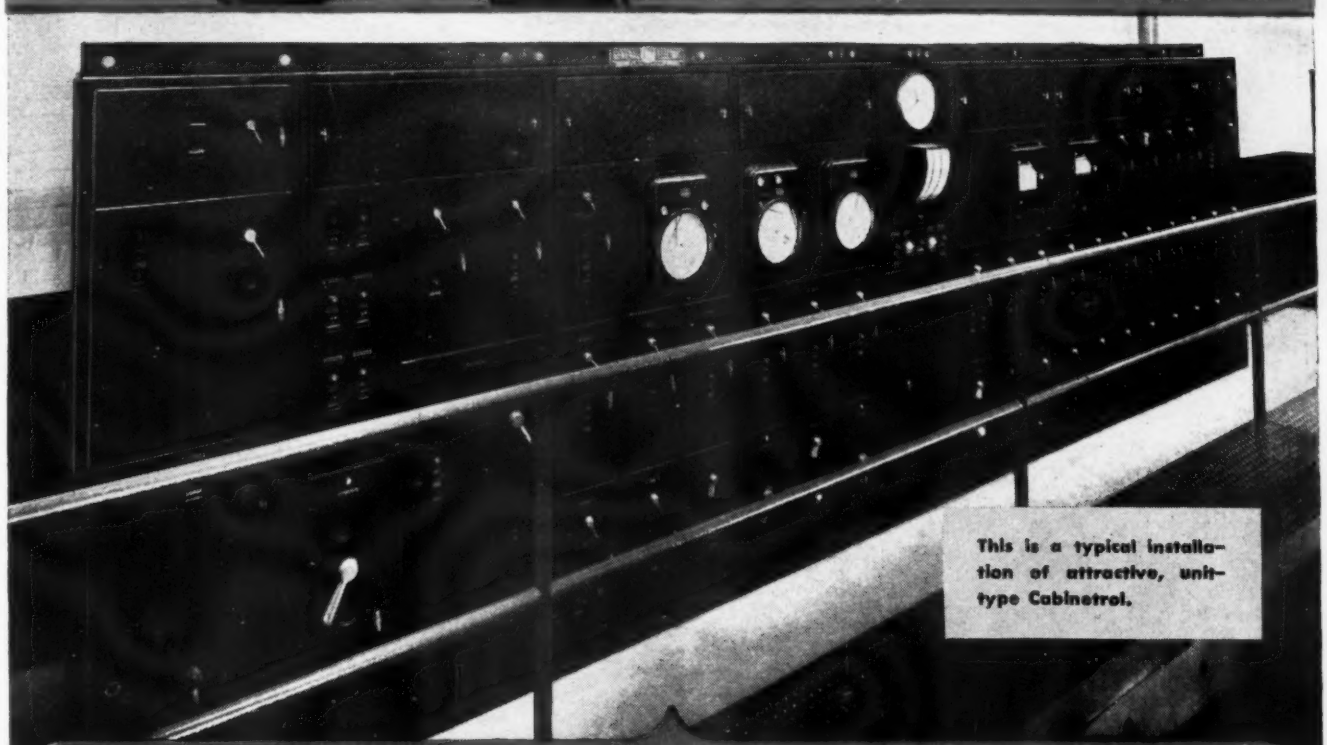
The 200- and 300-series journal bearings commonly available have metric bores and outside diameters, the same as light and medium series, standard ball bearings, but their widths are different. Bearings in the 200 series are made in three widths, Fig. 21 to 23. Medium or 300-series bearings, Fig. 24, are commonly made in same widths as double-row ball bearings.

Needle Bearings. Like all straight-roller bearings, needle bearings carry radial load only. They have a light cross-section compared to other roller bearings and are especially useful where radial space is limited.

Needle bearings are available with a hardened and ground inner race, Fig. 30, or without the inner race, Fig. 31. The latter may be used directly on a hardened and ground shaft. Most bearings have an oil hole in the outer race and some types are available with a groove for a snap ring.

Because of the great variety of types and sizes of straight-roller bearings it is essential to use care in ordering replacements. Ascertain the following information carefully, using it to make sure

HODGE-PODGE CONTROL IS EXPENSIVE!



This is a typical installation of attractive, unit-type Cabinetrol.

Trim, Modern CABINETROL Cuts Installation Time and Cost

Rambling, space-taking racks are a thing of the past. Control in the *modern* plant is compact, centralized G-E Cabinetrol. It's attractive in design, safe to operate, and it costs no more!

Cabinetrol saves installation time and expense because it's a single, self-supporting unit. No cumbersome frames—no cluttered walls. Just one attractive, all-metal unit that will greatly enhance the appearance of your mill.

The savings in installation cost that you get with Cabinetrol usually far outweigh its higher original cost. Only two operations are necessary—placing the unit in the designated location and connecting external power, motor, and control leads.

IT'S PRE-ENGINEERED

Cabinetrol is based on the use of standard enclosures equipped with the right combination of standard control devices. Each unit is pre-engineered to meet your specific requirements. All starters and accessory equipment necessary to your application are incorporated in the Cabinetrol unit before it is shipped.

PROTECTS YOUR OPERATORS

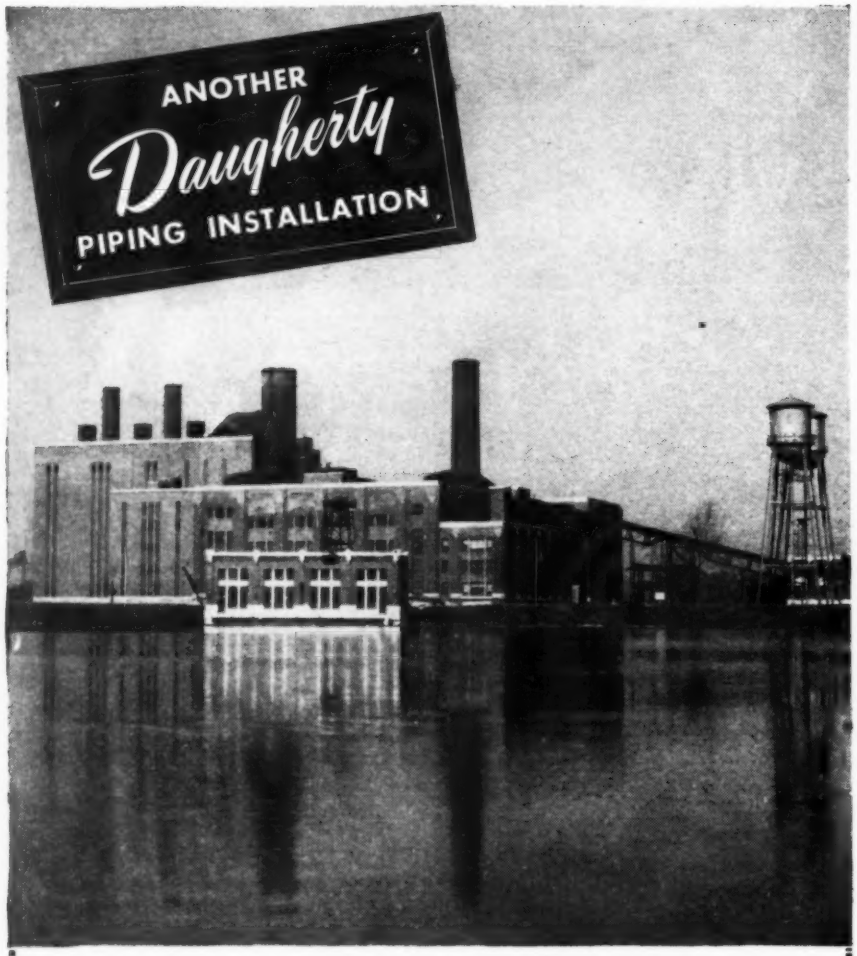
Because metal-enclosed Cabinetrol is completely deadfront, it offers your operators and servicemen maximum protection. Each motor control is installed in an individual sheet-steel compartment with an interlocking door. Operating mechanisms for motor-circuit switches and air circuit-breakers are available from the front of the panel.

LET US HELP YOU equip your plant with co-ordinated control. We'll be glad to work with you now—to provide a Cabinetrol system specially engineered for your plant—and, if you desire, to help you fit Cabinetrol into your over-all plans.

If you'd like more facts about Cabinetrol ask for Bulletin GEA-3856. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

G-E INDUSTRIAL CONTROL

GENERAL ELECTRIC



Indiana & Michigan Electric Co.
Twin Branch Station
Mishawaka, Ind.

The pipe fabrication and erection experience of the Daugherty Company is convincingly demonstrated by the successful handling of this outstanding installation having a normal operating pressure of 2350 lbs., at 940 degrees F.

To those responsible for power and process piping Daugherty Company offers these facilities: FABRICATION of high pressure, high temperature piping including alloy tubing. EQUIPMENT for field stress-relieving and radiographic inspection. WELDERS qualified for all classes of work. SUPERVISION by unexcelled metallurgical, engineering and construction staff.

Daugherty Company, Inc.

502 Union National Bank Building, Youngstown 3, Ohio

PIPING CONTRACTORS for the POWER and PROCESS INDUSTRIES

identification is correct: (1) manufacturer's name (2) bearing number, if possible (3) bore (4) outside diameter (5) width (6) number and diameter of rolls (7) identify type of construction, retainers, lips, races, oil holes, snap rings and other distinguishing features.

Reader's Problems

(*Continued from page* 113)

load. This arrangement requires an ac generator of smaller capacity, and less copper from his supply to the load center, and will obtain better voltage regulation and higher transmission efficiency.

He should give considerable thought to motor ratings and types. Squirrel-cage or wound-rotor induction motor has its specific application and advantage. I mention motor ratings since the usual practice is to install a motor of too high a capacity, which therefore operates at low efficiency and power factor.

Tenafly, N. J. K B HOFFMAN

Diesel Unit Ties in With 440-v System

I SUGGEST *DW* purchase the 440-v generator. This eliminates necessity of transformers and additional expenses for wiring switchboards and motors. Most of his motors will be rated for 220 to 440-v.

As for loss in the lines due to the lower voltage, this would be so small that it would never offset additional expenses for the 2300-v generator.

He should wire switchboard to tie in the 36-kva 440-v diesel-engine generator with the new 200-kva steam-engine generator. The diesel generator will then serve as emergency power source.

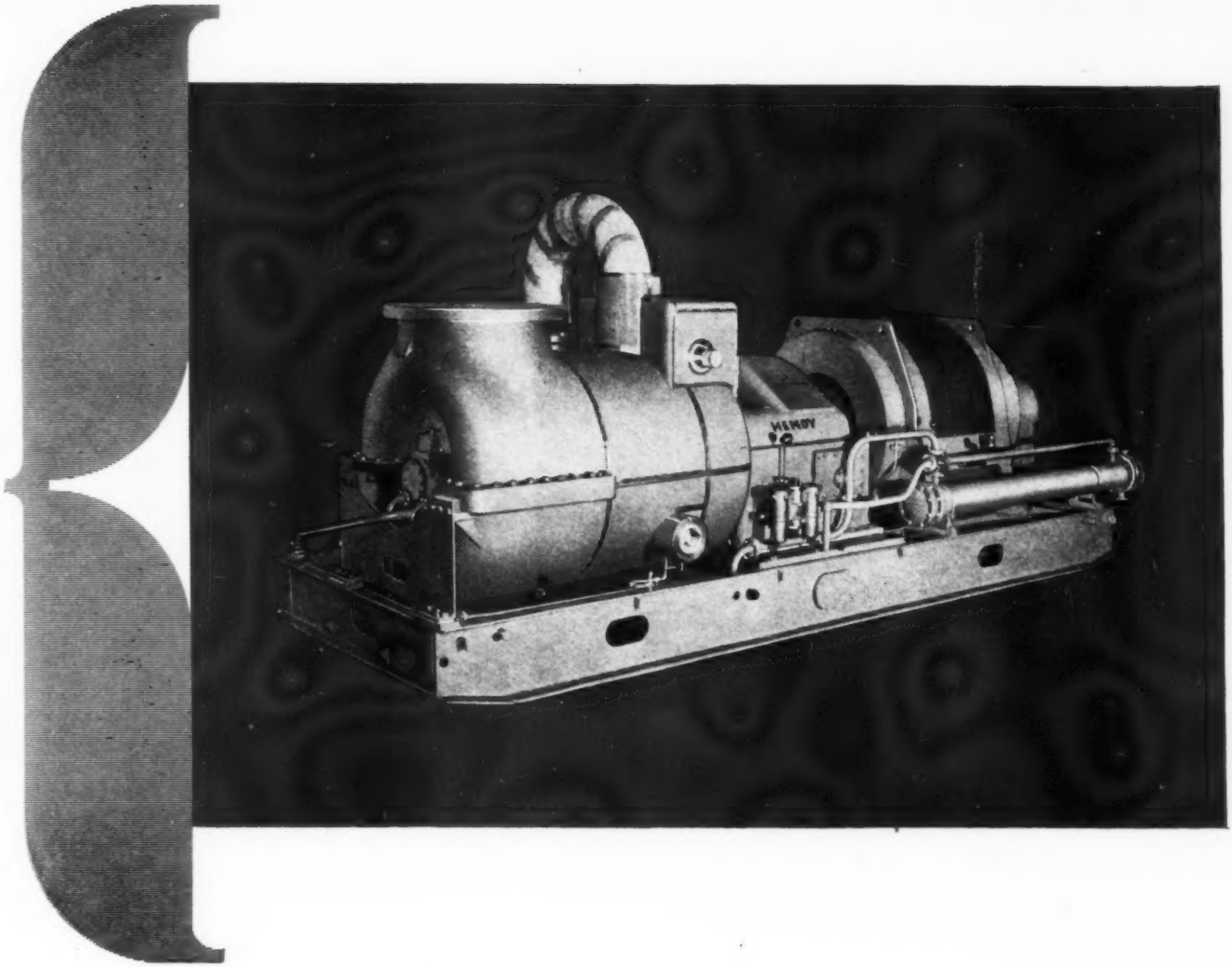
Brooklyn, N. Y. A J WENIG

Use Same Voltage As Present System

SINCE *DW's* MOTORS and circuits are already wired for 440-v it is more economical to buy the 440-v generator.

Most 2300-v motors can be used economically when circuits are already wired for such voltage or where synchronous motors are large, but for such a small plant 2300 v would not be economically justified. The higher cost for high-voltage switchgear, circuit breakers and motors would more than overbalance any small saving in current.

S Vineland, N. J. T DE ROSA



HAVE YOU CHECKED WITH HENDY?

You will want to add to your power plant files the new descriptive literature on Hendy steam turbines and turbo-generators. 250 kw. to 7,500 kw.

Power by Hendy

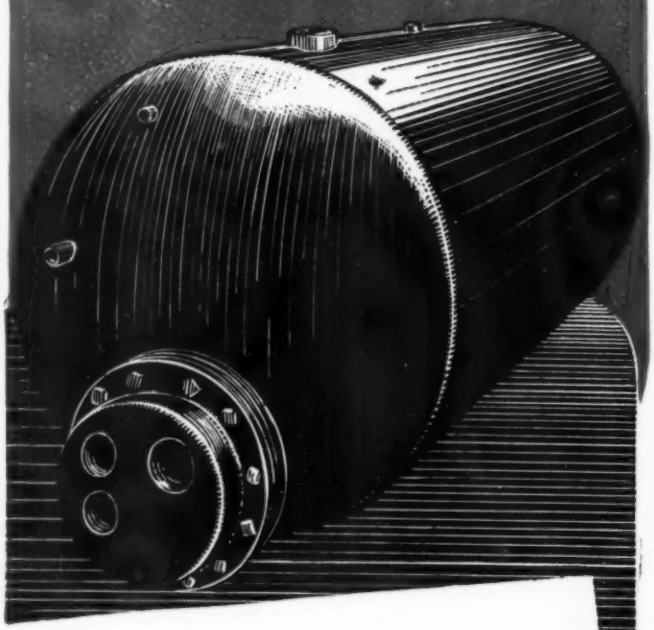
ENGINEERED TO SUIT YOUR NEEDS

Joshua Hendy Iron Works, Sunnyvale, California.
Plants: Sunnyvale and Torrance, California.
Crocker-Wheeler Electric Division, Ampere, New Jersey.
Branch offices: Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Washington.

TG-11

ADSCO

HEAT EXCHANGERS



Built by **AND FOR**
men who know
HEAT TRANSFER

The talent and experience that goes into ADSCO equipment is responsible for the performance you get out of it. ADSCO Liquid Heaters and Coolers are made in a complete line of standard and custom-made horizontal and vertical types with semi-steel shells or fabricated from steel plate, and special materials such as Copper Silicon Alloy, Toncan Iron, Nickel Clad Steel and other special materials which answer exacting requirements of modern processing. Correspondence is invited regarding any liquid heating or cooling requirement. Write for Bulletin No. 35-76 PR.

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N.Y.

MAKERS OF UP-TO-DATE STEAM LINE EQUIPMENT FOR OVER 65 YEARS

Argument Corner

(*Continued from page* 142)

GEORGE EDWARDS DRAWS FIRE

Heaven-Born Fish

IN REGARD TO George Edwards' editorial on page 140, June POWER, in which he mentions the myth of fish raining from the sky, I have this to say.

During the summer of 1897 three other boys and I were running down a dirt road near my home at Richwood, Union County, Ohio. There was a terrific rainstorm in progress and when it was over the road was covered with small fish. They were about one inch long and scattered about, say, three inches apart, over a distance of maybe 50 ft.

My solution is that a small-sized tornado lifted these fish from a small, nearby (1½ miles) creek and dropped them on the road.

I see no reason for calling this a myth for I saw it. I can furnish the name of another person who has seen the same thing. In fact, I have seen other things that puzzled me more.

Toledo, Ohio L L SCHEIDERER

Coal in Bathtubs

But they *did* put coal in bathtubs, Mr Edwards. I'm thinking of 1910 A.D. There were numerous apartments in that place called Yonkers. (I rented and lived in a 2nd-floor one with no central heating.) They were the last word in poor man's housing, with a kitchen range, water back, storage tank *and a bathroom* for each apartment.

The coal man sang his song every morning to sell coal by pail or bushel. To keep themselves warm many families found it more useful to store coal in the tub than to hold it open for the Saturday ceremony; the family wash tub was a habit for "fussy" people anyway.

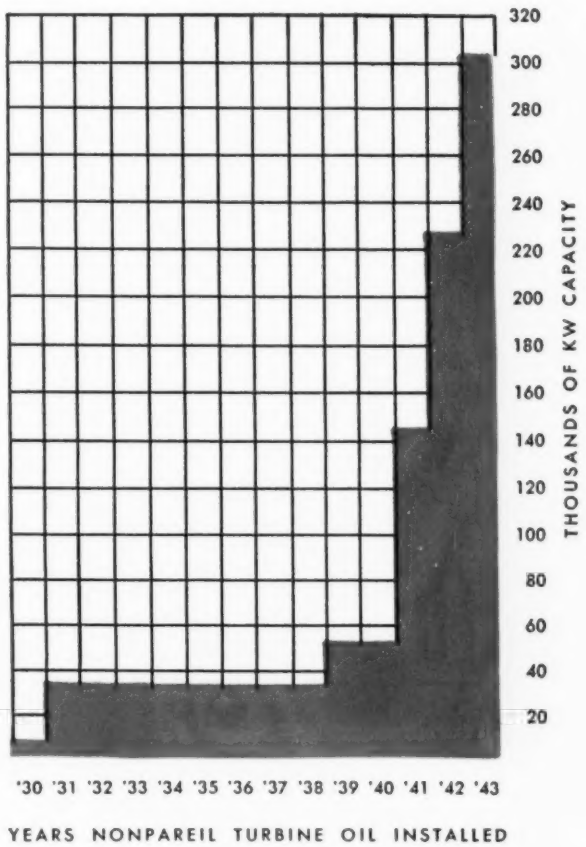
Funny, isn't it, how these ancient traditions outlive their times?

Falls Church, Va. J C RUNYON

(*Continued on page* 154)

A turbine oil that sells itself in the turbine . . .

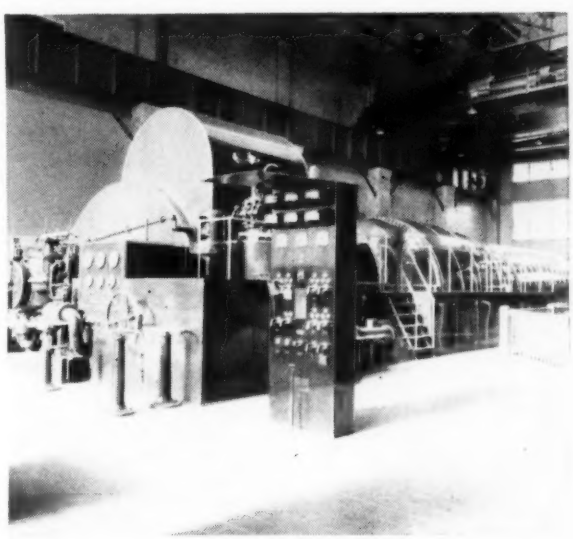
NONPAREIL
TURBINE OIL



HERE'S HOW Nonpareil, once installed in a turbine, sells itself to the user. A large Wisconsin utility company installed Nonpareil 16 years ago in one small unit. The chart at right shows how, year after year, turbine after turbine was put on Nonpareil as this power system grew.

Cleaner operation, continuous low acidity without oil treating, and guaranteed performance for the life of the turbine are some of the reasons why users install Nonpareil as new turbines are put into service.

A Standard Oil Lubrication Engineer can detail many advantages you'll get by filling your turbine with Nonpareil. Write Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois, for the nearest Engineer.



One of the two 80,000 KW turbines recently installed in a Wisconsin utility system in which Nonpareil is used. Equipment totaling over 300,000 KW is being lubricated by Nonpareil for this operator.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Fewer oil changes... less deposit with improved

STANOIL

FOR 18 YEARS Standard has provided an oil containing additives to reduce oil oxidation and formation of acidity and deposits in turbines.

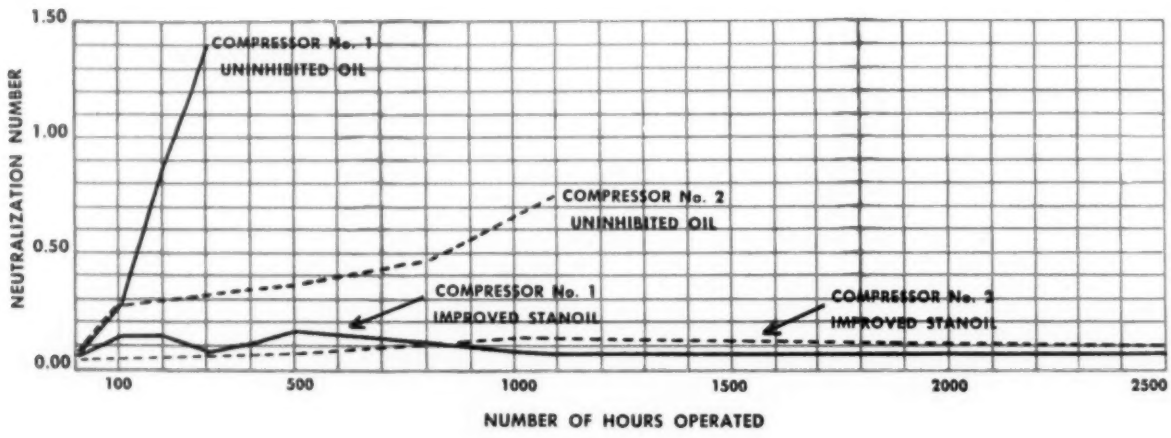
Now Standard has developed and incorporated in Stanoil an additive which improves oxidation resistance for a wide range of industrial applications. Improved Stanoil has been tested under the most severe operating conditions on many types of service: compressors, reduction gears, circulating and hydraulic systems.

Records of one of these severe tests in two compressors are charted below. They show the greatly reduced rate of acidity formation in Improved Stanoil as compared with oils previously used.

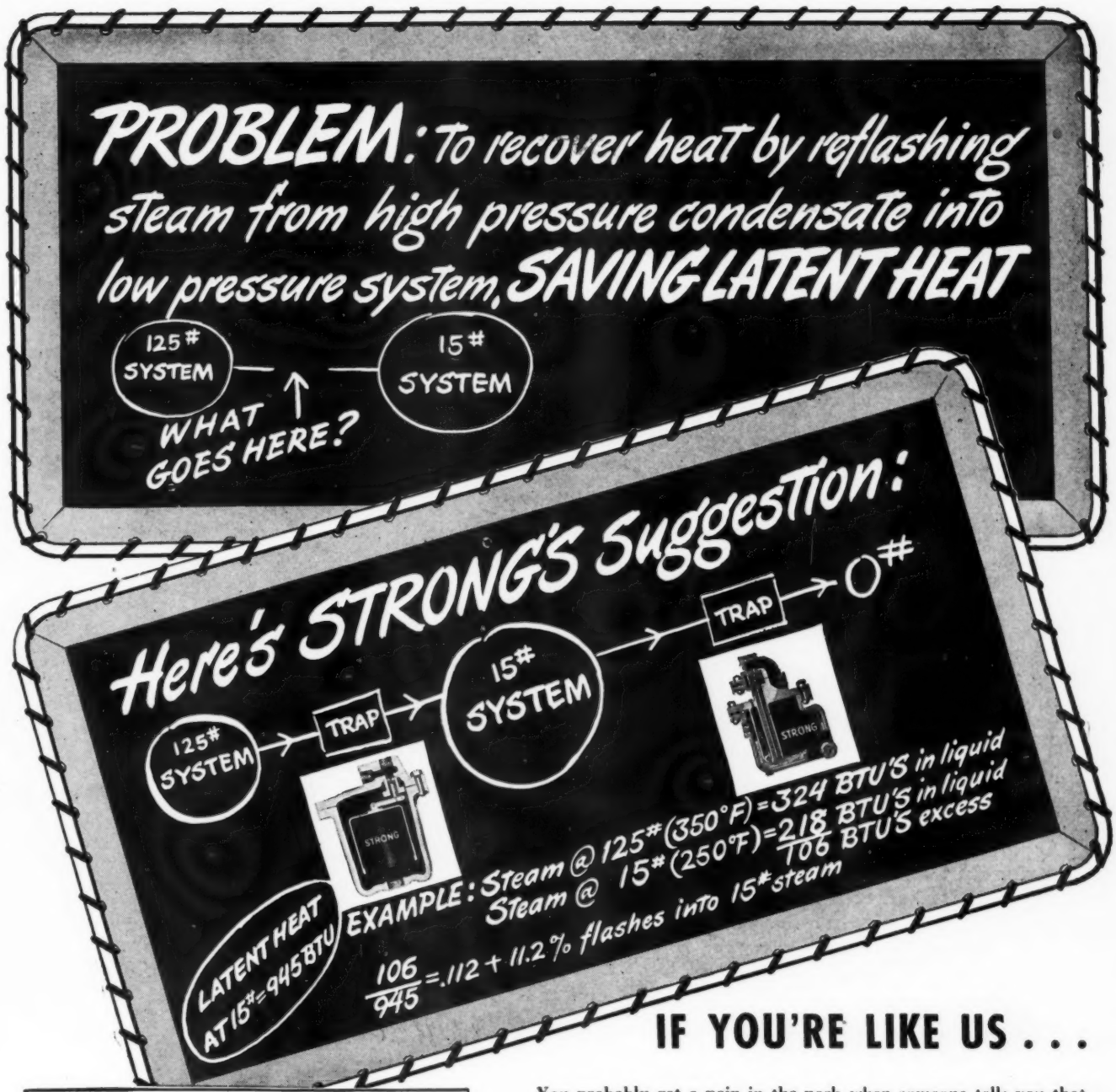
Try Improved Stanoil. Compare oil replacement records with the oil you now use in gear cases, circulating and hydraulic systems. Note how Stanoil reduces deposits in compressors.

A Standard Oil Lubrication Engineer will help you make a test. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

Adverse operating conditions and 24-hour a day operation imposed severe demands on the lubricating oil in two mine compressors. Conventional oil rapidly increased in acidity, as shown by the chart. Improved Stanoil maintained a safe low acidity throughout the 2500 hour test on Compressor No. 1 and for an additional 700 hours on Compressor No. 2 until it was shut down. Make-up was comparable with both oils.



STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE


PROBLEM: To recover heat by reflashing steam from high pressure condensate into low pressure system, SAVING LATENT HEAT
125# SYSTEM
WHAT GOES HERE?
15# SYSTEM
Here's STRONG'S Suggestion:
125# SYSTEM
TRAP
15# SYSTEM
TRAP
0#
STRONG
STRONG
LATENT HEAT AT 15#=945 BTU
EXAMPLE: Steam @ 125# (350°F) = 324 BTU'S in liquid
Steam @ 15# (250°F) = 218 BTU'S in liquid
106 BTU'S excess
106/945 = .112 + 11.2% flashes into 15# steam

IF YOU'RE LIKE US . . .

WHAT YOU CAN SAVE

Hi-Press. Condensate per hour	Reflash Steam (11.2%)	SAVINGS Per Hour	Per Day	Per 360 Days
1000 #	112 #	$.045	$1.08	$388.80
2000 #	224 #	.090	2.16	777.60
4000 #	448 #	.180	4.32	1555.20
5000 #	560 #	.225	5.40	1944.00
10000 #	1120 #	.45	10.80	3888.00

(Savings based on steam cost of 40c per 1000 lbs.)

You probably get a pain in the neck when someone tells you that changing from Whosis to Whatsits will save you more than you pay in taxes.

Sure, good equipment can pay its way. And installing the right type shows up the waste caused by using the wrong type.

But real savings grow out of ideas. That's where Strong comes in on steam. With a *complete* line of traps and other specialties, Strong engineers can apply a lot of proved ideas to your installations —and not have to compromise for lack of the right kind of unit to do the best possible job.

Try sending your drainage problems to:

STRONG, CARLISLE & HAMMOND COMPANY
Cleveland 13, Ohio

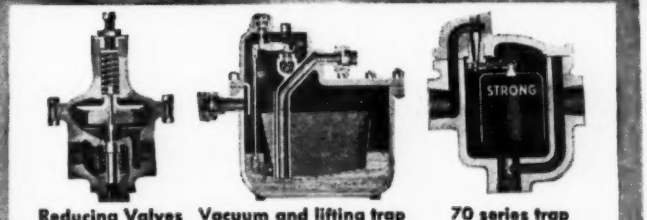
REG. TRADE MARK

OTHER

ANUM-METL Reg. Trade Mark

STRONG

STEAM SPECIALTIES



Reducing Valves | Vacuum and lifting trap | 70 series trap

We Didn't Want to Make Strainers

BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.*

Apparently a lot of other people were having "Strainer trouble" because, without a line of advertising, the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (over 100 Mill Supply Houses now have them).

Examine its *high grade Monel woven wire screen* that stops dirt—lets condensate or other fluids flow freely.

Notice the removable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

Cadmium plated for protection against corrosion and for better appearance.

Six standard sizes from ½" to 2" for pressures to 600 lb.

See your Mill Supply House or write for Bulletin S-201

YARNALL-WARING COMPANY
100 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

Keep Tabs on Rust Growth In Cast-Iron Boilers

I WOULD LIKE to call attention to a fault common to cast-iron boilers in addition to those mentioned by Harry M. Spring, page 107, May POWER. After several years' service a condition known as "rust growth," sometimes develops between cast-iron boiler sections. This condition starts as a rust film that grows in successive layers. It is not uncommon for the layers to build up to ¼-in. thick or more. This is caused by condensation attacking the iron and is accelerated by soot. Eventually there is no room for normal expansion and contraction of the boiler, with the result that its sections are overstressed and may crack.

During each cleaning or inspection of a cast-iron boiler look for rust growth and, if found, remove it with a thin scraper or a hacksaw blade. Sometimes it is necessary to dismantle the boiler sections to remove external rust growth.

The same condition may develop on the sinuous headers of high-pressure boilers. It is especially important that these headers be kept clean, because the boiler may be needed in a hurry when cold. If the boiler is forced to put it in service quickly, unequal expansion may overstress the headers to a point where they will crack, unless they are clean and free of rust growth.

Philadelphia, Pa. J S HAMILTON

New Developments

(*Continued from page* 91)

Electric Co., discussed experiences in burning Midwestern coals on a spreader stoker with continuous ash discharge. This Detroit stoker fires a Combustion Engineering boiler rated at 125,000 lb per hr, 420 psig, 750 F, at the Iowa Falls plant, Fig. 5. Boiler and stoker were in continuous operation for 5352 hours before inspection, burning bituminous coals of lower rank from Illinois and Iowa fields, having ash-softening temperatures of about 1950 F and relatively high ash and moisture content.

The speaker presented complete design data on the boiler and firing equipment, analyses of the coals, a description of operating experiences and a report of conditions found on inspection of the unit when it was taken off the line. Tests using station instruments showed an efficiency of 84-85% at 88,000 lb per hr, while average steam cost per 1000 lb was 30.6c, exclusive of maintenance.

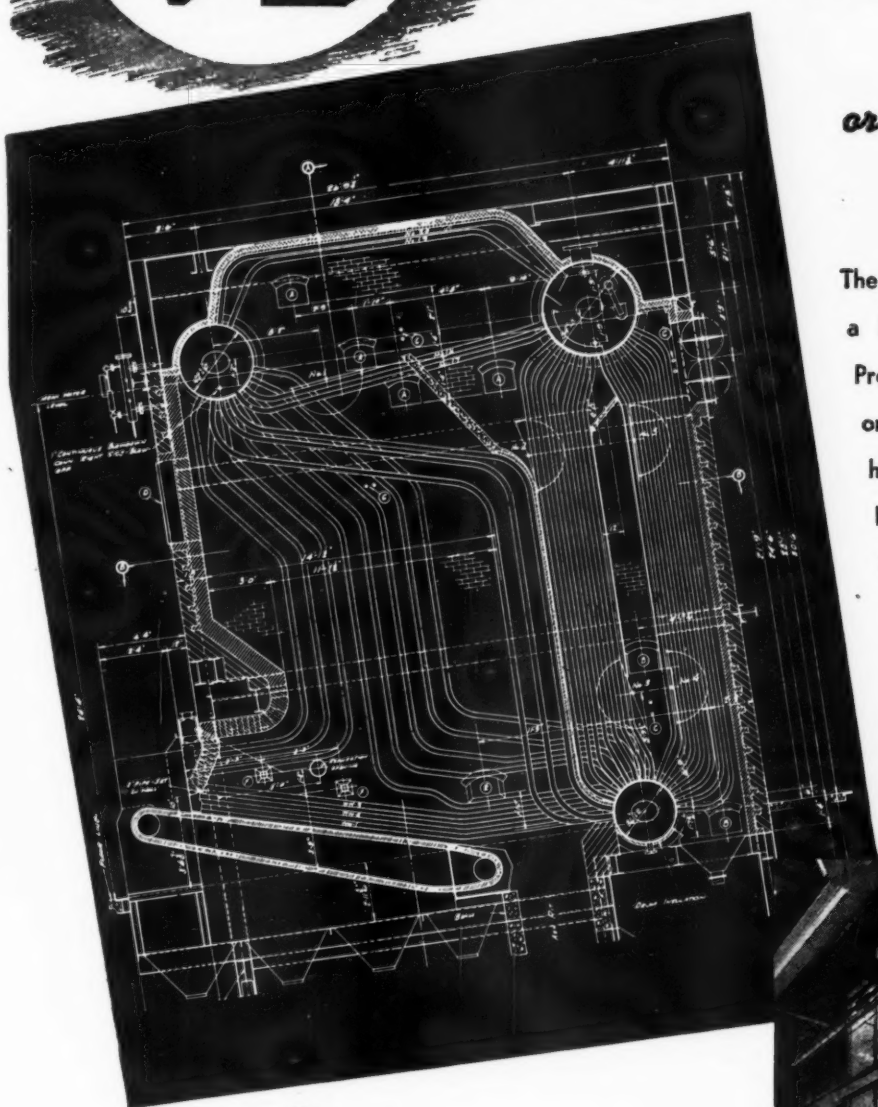
CLASS **VL**

Vögt

Steam Generating Units

for POWER *or* PROCESSING LOADS, *and* HEATING

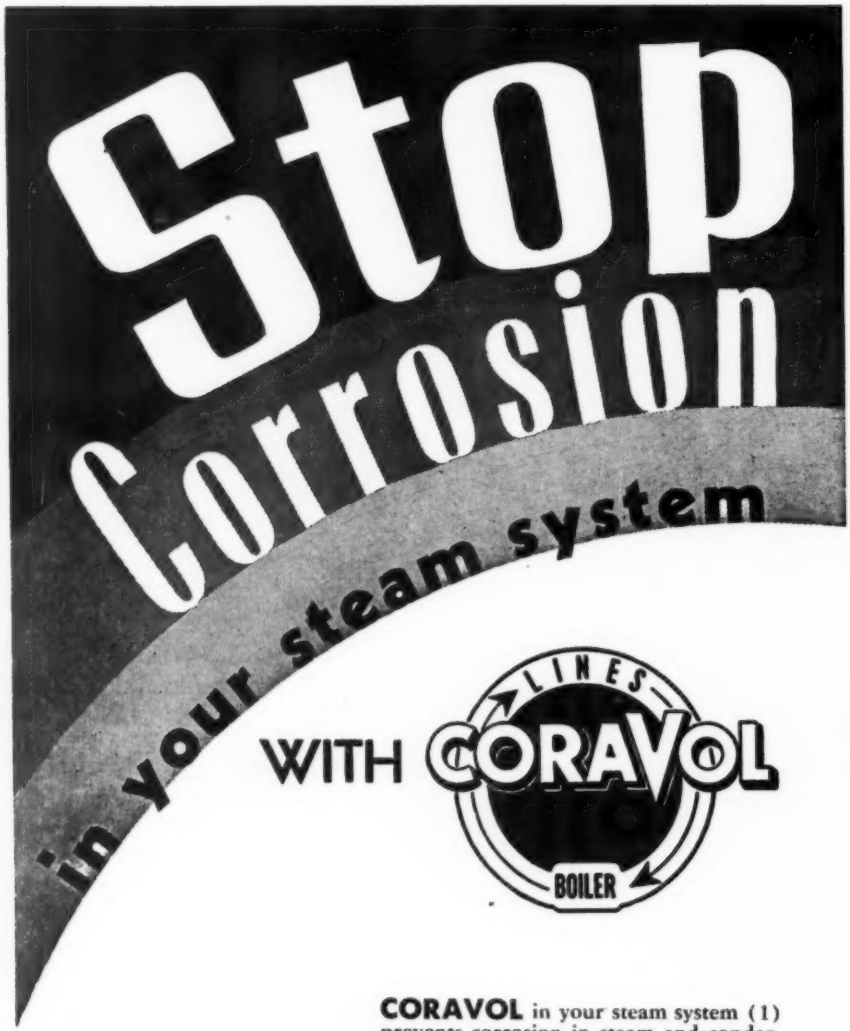
The design provides large furnace volume and a high ratio of radiant heating surface. Proper combustion is assured with any fuel or method of firing. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Vogt Class VL Steam generating units are giving satisfactory service in Hotels, Sugar Refineries, Steel Mills, Furniture Factories, Distilleries, Oil Refineries, and related industries. A bulletin showing typical installations will be sent upon request.



Above:
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.

Right:
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.

HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.
Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas



CORAVOL in your steam system (1) prevents corrosion in steam and condensate lines, (2) cleans out clogging rust deposits resulting from previous corrosion. Thus, **CORAVOL** *protects lines;* increases effectiveness of heat transfer surfaces; restores original capacity of lines and the operating efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates thruout your entire steam system and protects *all* zones from corrosive attack.

For 9 years, **CORAVOL** has proved its value in hundreds of steam heating, process and power plants in more than 20 different industries.

WRITE TODAY for complete FREE data about the **CORAVOL** process.

The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

CORAVOL is part of a complete technical service which provides special formulas of treatment for:

Boiler Feed Water . . . Hot Water Supply . . . Refrigerating Brine . . . Cooling and Condenser Water . . . Rapid Scale Removal . . . Coagulation . . . Algae Control.

WESTERN CHEMICAL COMPANY

715 WASHINGTON **KANSAS CITY 6, MISSOURI**

56 Years of Know-How in the Chemical Treatment of Water

Operating difficulties were minor in character and concerned auxiliaries. Experience indicates that the stoker will handle any available coal with good results, a minimum of operating labor is required and the unit is particularly adaptable to automatic control. Maintenance appears likely to be low. The cinder collecting and return system (Western Precipitation Corp multiclone) has proved effective and there has been no cinder nuisance around the station.

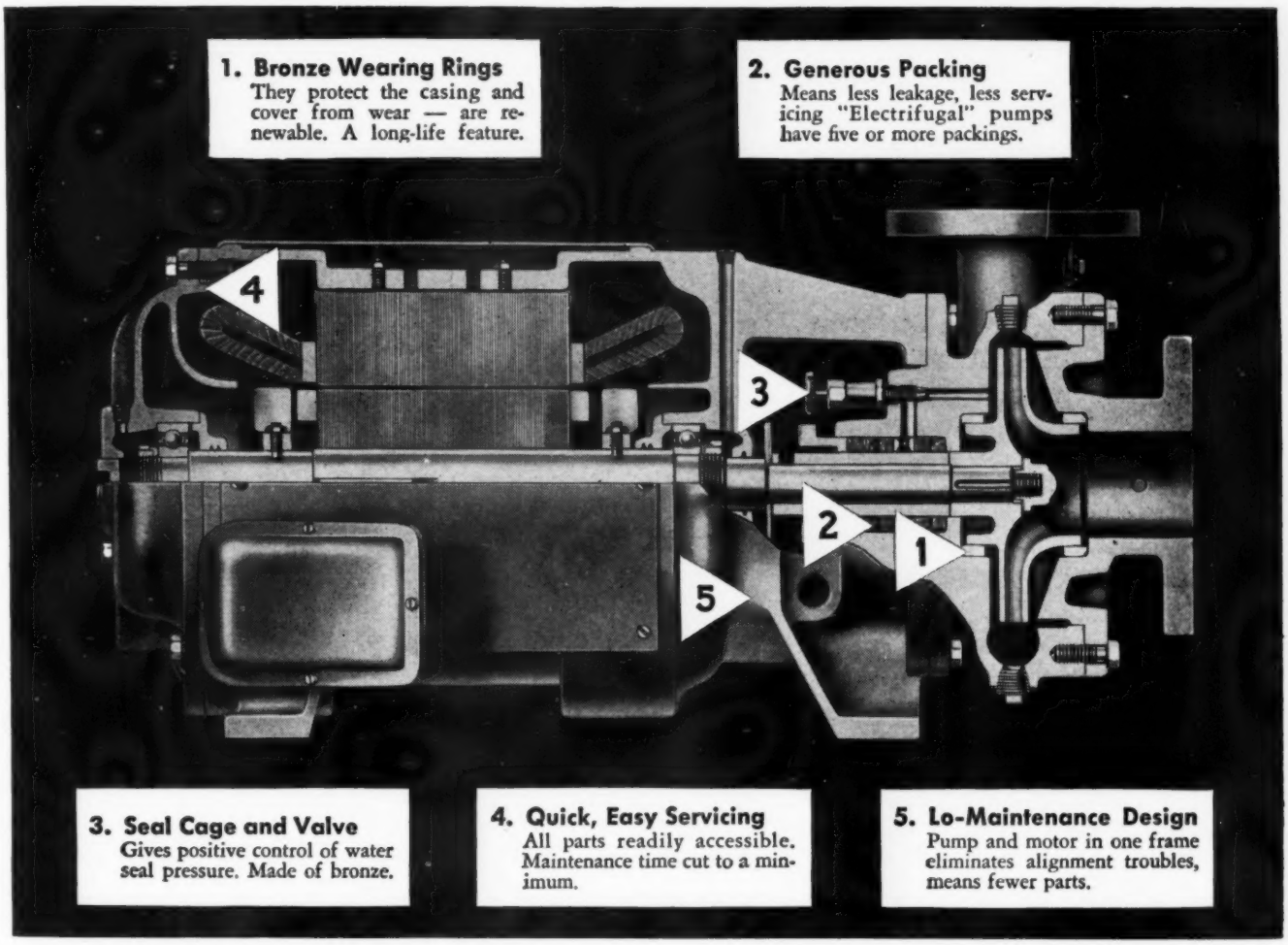
Acid-Cleaning of Boilers

Pointing out that acid-cleaning of boilers and auxiliary equipment has been demonstrated as a useful and economical means for removing encrustations, S T Powell, consulting engineer, discussed the various cleaning agents and dealt extensively with the several theories of the mechanism by which inhibitors protect steel or other metals in contact with acid solutions. Considering the practical effect of acid-cleaning on boiler steel, he pointed out that some corrosion occurs each time but rate of attack is not rapid enough to cause concern. Effect of acidizing may best be evaluated by scrupulous before-and-after inspections; if this is done, acid-cleaning will not be blamed for corrosion that occurred previously and passed unnoticed because covered with iron oxide or encrustations.

Conditions which should be controlled in acid-cleaning operations are: (1) composition and concentration of acid (2) nature and composition of inhibitor (3) additional chemicals employed for their wetting, catalytic or special solvent properties (4) temperature of metal and solutions (5) circulation of cleaning agent (6) composition of the metal (7) physical and chemical composition of scale to be removed and (8) procedure followed throughout cleaning operations. Powell covered each of these factors in some detail, and presented a table of types of deposits found in boilers and miscellaneous power-plant equipment, including the formulas as determined by X-ray analysis. He concluded by outlining some of the hazards involved in acidizing, stressing the need for doing the work under experienced and competent supervision and only when necessary. There must always be assurance that acid can be completely removed or neutralized after cleaning is complete.

In a session devoted to problems of smoke elimination and dust collection, R B Foley, supervisor of dust-collector research, American Blower Corp, discussed the matter of particle size, pointing out that size figures for particles below the sieve range are frequently determined by the processes of elutriation or sedimentation.

CONSTRUCTION DETAILS
that cut pump maintenance costs


1. Bronze Wearing Rings
They protect the casing and cover from wear — are renewable. A long-life feature.
2. Generous Packing
Means less leakage, less servicing "Electrifugal" pumps have five or more packings.
4
3
2
1
5
3. Seal Cage and Valve
Gives positive control of water seal pressure. Made of bronze.
4. Quick, Easy Servicing
All parts readily accessible. Maintenance time cut to a minimum.
5. Lo-Maintenance Design
Pump and motor in one frame eliminates alignment troubles, means fewer parts.

GET THEM ALL...

These fine-construction features are guide-posts to longer service — lower pumping costs. Look for them in the pump you buy.

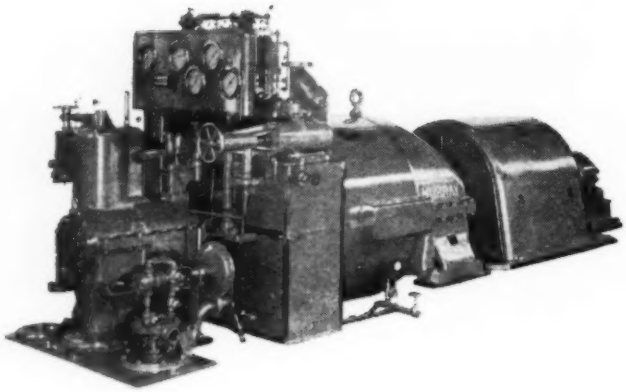
You get them all — and more — in an Allis-Chalmers "Electrifugal" pump. By mounting pump and motor on the same shaft and in the same frame, Allis-Chalmers engineers not only save space, but they simplify construction and reduce cost. They give you a pump that's quickly installed — operates in any position — has almost endless applications. Made in stock sizes from ¾ to 25 hp.

PART OF THE COMPLETE LINE

Other Allis-Chalmers centrifugal pumps and motors in capacities to 170,000 gpm! Single suction, double suction and multi-stage. Call your Allis-Chalmers office or dealer — or write for bulletin No. B6018. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2038

ALLIS CHALMERS *Electrifugal* **PUMPS**

MURRAY
STEAM TURBINE GENERATING UNITS



Installed in 1939 in a small municipal power plant in northeastern Indiana, the above 500 KW direct connected Murray steam turbine generator set has given its owner entire satisfaction. The turbine is equipped with every device necessary for minimum of attention including steam turbine driven auxiliary oil pump. The generator and exciter may be furnished to match existing electrical equipment in your plant.

Units in this size may be furnished either direct connected or geared as preferred with performance and operation equally trouble-free.

There is a Murray representative ready to help you with design and layout information.

MURRAY *also produces*

Mechanical Drive Turbines — Horizontal and Vertical Reduction Gears of the high speed type Steam Boilers

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

These methods determine the terminal velocity of a particle and from this particle size is often figured by Stokes Law, which assumes that particles are spherical and of uniform density. However, actual dusts may depart considerably from this assumed shape and may display wide divergences in specific gravity, thus leading to essentially fictitious particle-size values. Foley recommended dealing in terms of terminal velocity, which takes account of size, shape and density, the characteristics of a dust that determine its behavior in air or any other fluid and the ease with which it can be separated from an air stream.

Smoke-Abatement Panel

This session also included a panel discussion on smoke abatement, under the chairmanship of J F Barkley, Bureau of Mines. Members of the panel were: W A Carter, technical engineer, Detroit Edison Co; F. J. Gibbons, acting chief smoke inspector, City of Detroit; F A Chambers, deputy smoke inspector, City of Chicago; H F Hebley, director of research, Pittsburgh Coal Co; W E E Koepler, secretary, Pocahontas Operators Assn; F B Brundage, smoke abatement engineer, City of Rochester. A considerable part of the discussion centered around specific provisions of smoke ordinances with points of view varying from "no smoke at any time" coupled with flexible enforcement, to codes setting down definite smoke rules and rigid enforcement. Carter stressed the need for differentiation between "smoke" and "dust" and presented several charts showing the effect of stack height and gas velocity and illustrating the so-called "downwash" problem in the neighborhood of large power plants.

Smoke and Business Activity

In an effort to find out whether there is a relation between business activity in an industrial area and atmospheric pollution in that area, an analysis was made of available records at the city of Pittsburgh. Charts shown by H F Hebley revealed an interesting correlation between the iron and steel index, chosen as most representative of business conditions in Pittsburgh, and three measures of atmospheric pollution from Weather Bureau records. These measures are (1) hours sunshine (2) visibility in miles and (3) smoke density on a comparative scale. A special study made during the recent steel strike showed that, measured by visibility, atmospheric pollution was definitely less during the period the mills were shutdown, but that the contribution of the steel mills to the smoke problem is not as great as might have been expected.

START RIGHT

Prevent Wire-Failures

WITH

ROCKBESTOS A.V.C.

Get started on a failure-prevention campaign if you want to avoid future trouble in your power, control and lighting circuits. Look into all possible trouble-starters such as high ambient temperatures, probable overloads, exposure to moisture, oil, grease and corrosive fumes . . . then use Rockbestos A.V.C., the wire designed to meet these conditions.

These permanently insulated wires and cables guarantee long and trouble-free service in circuits exposed to severe operating conditions because they have an *impregnated asbestos insulation* that is heat and flame resistant. It won't bake brittle, crack or flow in temperatures up to 230°F . . . and won't deteriorate with age or rot when exposed to oil, grease or fumes.

Protect hot-spot circuits around boilers, furnaces, kilns, soaking pits, pump rooms, steam tunnels and heat-exposed ducts with Rockbestos A.V.C. It will eliminate re-wiring jobs and expensive maintenance. 125 different standard types are available in 600 to 5000 volt ratings. Write for catalog and samples.

ROCKBESTOS PRODUCTS CORPORATION
150 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C. 600 VOLT
POWER CABLE—NAT. ELEC. CODE TYPE AVA

The cable illustrated has an impregnated asbestos and varnished cambric insulation protected by a heavy asbestos braid. Also furnished with lead sheath or armor coverings and in multi-conductor construction. Similarly insulated cables are available in 1000 to 5000 volt ratings.

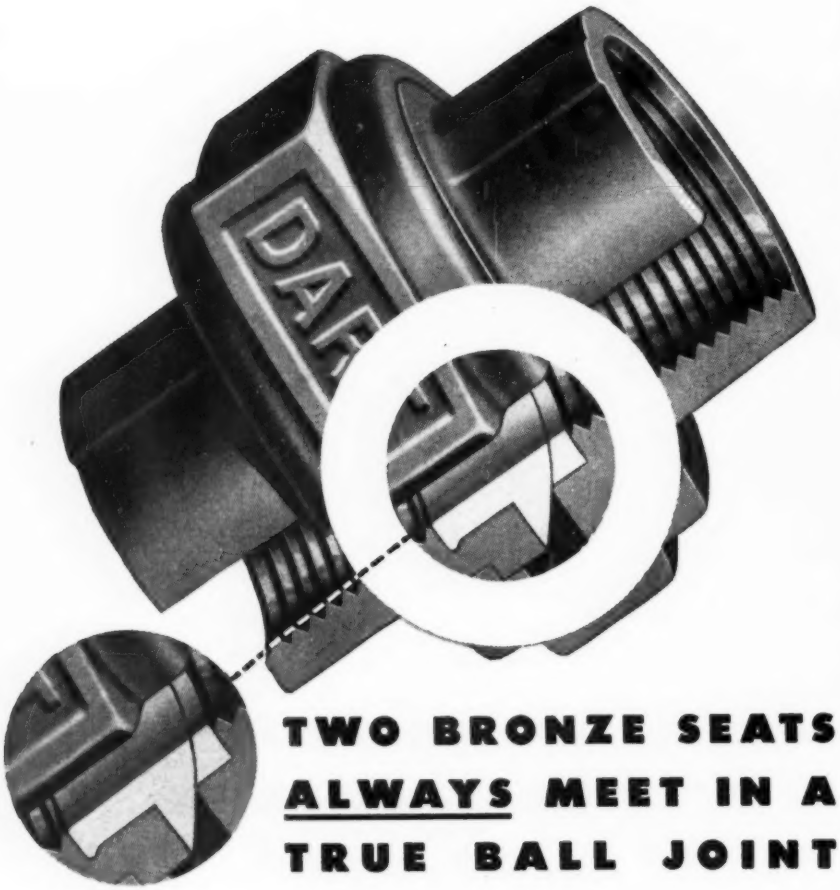
ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK
BUFFALO
CLEVELAND
CHICAGO
PITTSBURGH

ST. LOUIS
LOS ANGELES
SAN FRANCISCO
SEATTLE
PORTLAND, ORE.

Darts
Don't Deviate



TWO BRONZE SEATS ALWAYS MEET IN A TRUE BALL JOINT

Because their two bronze seats are ground to form a true ball joint, Darts may be closed to a leak-proof connection with the greatest of ease—and may be uncoupled just as easily if needed for other services. Body and nut are made of high-test air-refined malleable iron—practically indestructible. That's why far-sighted buyers prefer Darts. They last longer—cost least in the long run.

Let your supplier show you Dart's unique construction.

E. M. DART MANUFACTURING CO.
PROVIDENCE 5, R. I.

DART UNIONS

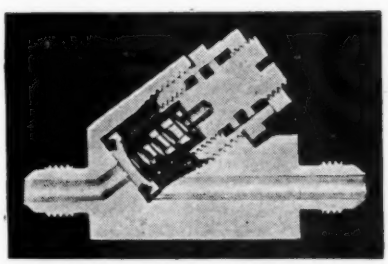
New Equipment

(*Continued from page* 138)

color harmony and distinctive dial markings. *Supergauges* are made in pressures ranging from 30 psi to 10,000 psi and come in 4½- 6- and 8½-in. dial sizes. They serve on boilers, diesel engines, hydraulic equipment, compressors, pumps, etc. **Dept P, American Machine & Metals, Inc, Sellersville, Pa.**

Lacquer Resin

PRINCIPALLY FOR LACQUERS, CELLOLYN 102, a rosin-base resin, may be used in place of rosin maleates. It is claimed to be suitable as a resinous component of nitrocellulose lacquers for a wide range of industrial applications as well as for furniture lacquer-finishing systems and in lacquer primer surfaces. **Dept P, Hercules Powder Co, Wilmington, Del.**



Pressure-Relief Valve

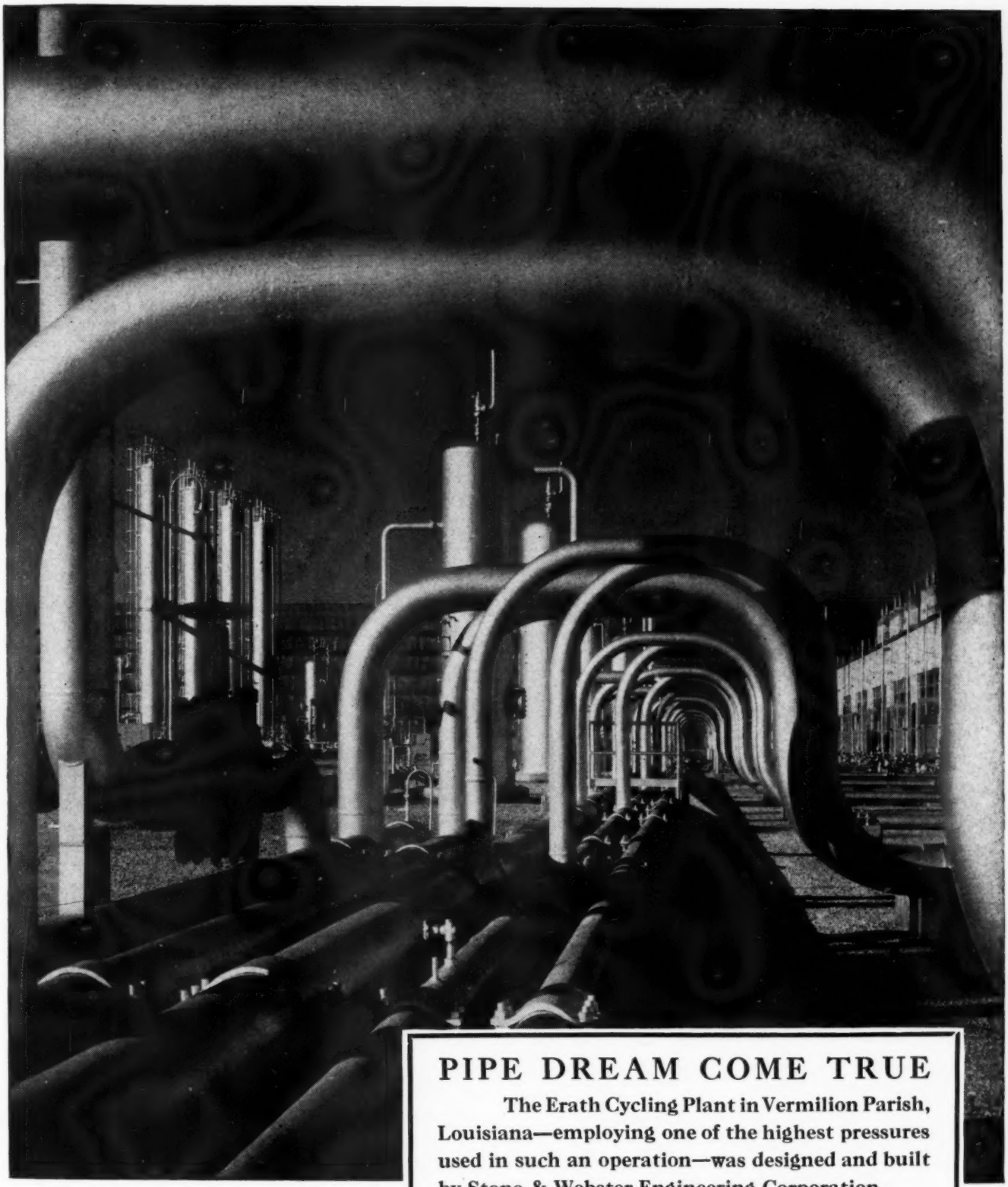
AEROTEC PRESSURE-RELIEF VALVE maintains a predetermined pressure by relieving any excessive pressures that may take place in fuel and hydraulic lines. Valve can easily be set to desired pressure, at any time, without interrupting its operation, by an outside adjusting screw. This eliminates necessity for disconnecting either inlet or outlet and makes possible inspection of entire valve assembly without disconnecting it from main line. These new Aerotec pressure-relief valves are available for pressures ranging from 5 to 100 psi in units having individual ranges of about 15 psi.

Inlet and outlet are in a straight line. Over-all dimensions are: length, 2⅞ in.; width, ⅞ in.; height, 2 in. Valve weighs 4 oz. **Dept P, Aerotec Co, White Plains, New York.**

Circular Slide Rule

PRECISION OF A 12-IN. SLIDE RULE is combined with pocket-size convenience in simplified *Calculaide* commerce slide rule. Accuracy is enhanced by locating most-used scales close to edge, so that each is actually 12½ in. long. Easy reading is assured by contrasting colors on scales. Also in problems of proportion, etc, such contrasting colors aid in remembering which variable each scale relates to. Graduations are reproduced on facing surfaces, protected with a thin plastic lamination.

Precision centering and durable construc-



PIPE DREAM COME TRUE

The Erath Cycling Plant in Vermilion Parish, Louisiana—employing one of the highest pressures used in such an operation—was designed and built by Stone & Webster Engineering Corporation.

We offer industry wide experience in engineering and construction problems—from the most complicated to the simplest.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER INC.

SERVICE STEPPED UP

AT LOWER COST FOR ALL AIR EXPRESS SHIPMENTS

NOW! THE LID IS OFF

More Planes, More Flights — For Everybody. Priorities No Longer Needed!

More Planes in service, more flights, more space available for all kinds of traffic! Bigger planes, swifter planes, faster air schedules on many runs!

Every way you figure, Air Express service is stepped up to an all-time high at an all-time low in cost to the shipper.

Reduced Rates (see table) include special pick-up and delivery between airport towns and cities. Rapid air-rail schedules to and from 23,000 other communities in this country.

Foreign Service direct by air to and from scores of foreign countries — the world's best service, in the world's best planes.

Write Today for the Time and Rate Schedule on Air Express. It contains illuminating facts to help you solve many a shipping problem. Air Express Division, Railway Express Agency, 230 Park Avenue, New York 17. Or ask for it at any Airline or Railway Express office.

RATES CUT 22% SINCE 1943 (U. S. A.)					
AIR MILES	2 lbs.	5 lbs.	25 lbs.	40 lbs.	Over 40 lbs. Cents per lb.
149	$1.00	$1.00	$1.00	$1.23	3.07c
349	1.02	1.18	2.30	3.68	9.21c
549	1.07	1.42	3.84	6.14	15.35c
1049	1.17	1.98	7.68	12.28	30.70c
2349	1.45	3.53	17.65	28.24	70.61c
Over 2350	1.47	3.68	18.42	29.47	73.68c
INTERNATIONAL RATES ALSO REDUCED					

AIR EXPRESS

AIR EXPRESS — GETS THERE FIRST

Phone AIR EXPRESS DIVISION, RAILWAY EXPRESS AGENCY
Representing the AIRLINES of the United States

tion eliminate need for centering adjustment. A further feature is elimination of seldom-used scales. *Calculaide* carries the usual C and D scales, plus a log-log scale ranging from 1.01 to 100, which appears as an inner spiral of almost three turns and which is conveniently arranged for computing in one setting compound-interest problems. **Dept P, American Hydromath Co, 145 W 57th St, New York, N. Y.**

Fluid-Drive Coupling

FIREBAUGH FLUID-DRIVE COUPLING operates on *Vulcan-Sinclair* principle, eliminating necessity for both a transmission and differential mechanism. This self-contained hydraulic oil coupling consists of three basic parts. Principle of operation is simple. It can be installed directly on shaft of any engine or electric motor. Coupling engages and disengages without human control and slippage is eliminated. It serves for refrigeration units, hoists, cranes, winches, conveyor systems, packaging machines, and wherever smooth starting and stopping of power-driven equipment is necessary. Completely inclosed coupling prevents entrance of dirt and dust. **Dept P, Toolcraft Mfg Co, Huntington Park, Calif.**

Dial Thermometer

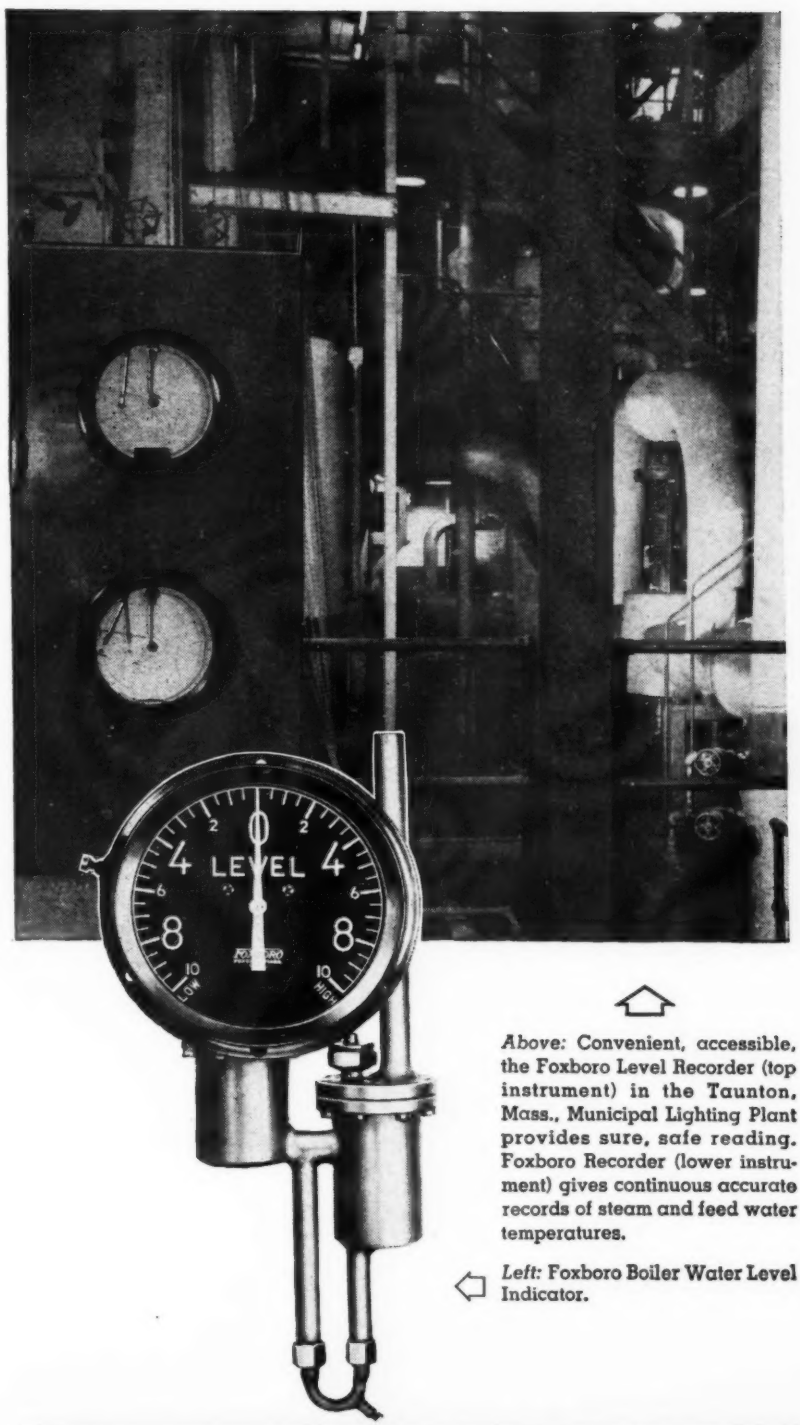
ALL-METAL DIAL THERMOMETER indicates temperatures from 100 to 950 F. Slip-on handle protects operator's hand when instrument is in portable use. Handle can be easily detached when instrument is to serve as a permanently mounted indicating thermometer. Bimetallic temperature element has no pivots, mechanical linkages or gears. Thermometer is made with corrosionproof stainless-steel stem, $\frac{1}{4}$-in OD and 5-in. free length, with only 2-in. immersion required to obtain accurate readings. It is also available with $\frac{3}{8}$-in. OD stem having 9-in. free length. **Dept P, Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh 8, Pa.**

Magnetic Crane Controllers

COMPLETE NEW LINE of controllers operate ac cranes from floor level. The controllers operate from a pendant pushbutton station or from rope-operated master switches.

For mounting on trolley or along crane girders, controllers are of magnetic contactor design with accelerating and speed-limiting functions controlled by frequency

They Even Prevent Human Forgetfulness!



Above: Convenient, accessible, the Foxboro Level Recorder (top instrument) in the Taunton, Mass., Municipal Lighting Plant provides sure, safe reading. Foxboro Recorder (lower instrument) gives continuous accurate records of steam and feed water temperatures.

Left: Foxboro Boiler Water Level Indicator.

Foxboro Liquid Level Indicators and Recorders bring boiler-water readings out where they practically can't be overlooked!

Here's a typical example of the engineering thoroughness that goes into the design of every type of Foxboro Instrumentation.

Even the hazards of human carelessness in boiler operation have been foreseen in the design of Foxboro Boiler Water Level Instruments. These safer level gauges are designed for mounting at eye-level in the most-accessible location . . . *where frequent reading practically can't be overlooked!*

What's more, the Indicator has a highly visible dial that shows up clearly in any light where men can work. The Recorder not only permits easy check-up at any instant, but provides continuous graphic records to *prove* whether correct level has been maintained.

Foxboro Boiler Water Level Indicators and Recorders are made for any pressures encountered in modern steam power plant practice. Simply, ruggedly constructed to serve many years without maintenance. No glass to break . . . easily installed without disturbing the gauge-glass. Write for detailed information. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U. S. A.**

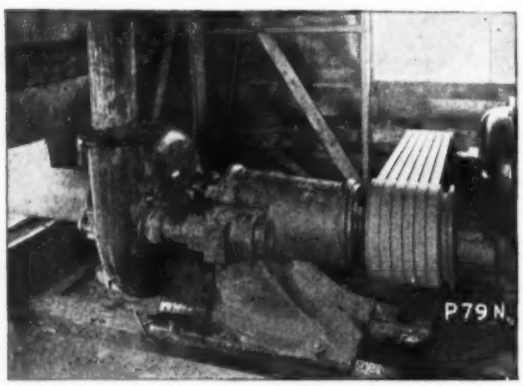
FOXBORO
REG. U. S. PAT. OFF.

BOILER WATER LEVEL INSTRUMENTS

Abrasive Ashes Meet Their Match In This Rugged Pump

The Amsco-Nagle Type "T" pump is designed and built for operation under the most abusive service conditions, including ash handling. This horizontal shaft, single stage, side suction centrifugal pump withstands abrasive wear, in addition to meeting the requirements of mechanical and hydraulic efficiency.

Simplicity and ruggedness, so highly important in such a job as pumping ashes, are inbuilt features. In addition to the shaft,

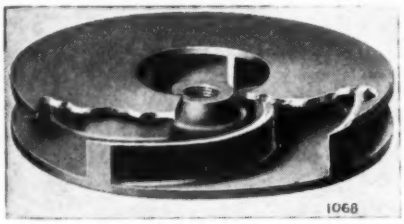


P-79-N. A 6" Type "T" frame 19 Amsco-Nagle pump, V-belt driven.

which can be protected by a sleeve where it passes through the stuffing box, there are only three parts of this pump which come in contact with the material pumped. All parts which may require adjustment or replacement are readily accessible.

The "water end" parts are made of austenitic manganese steel which is best suited to withstand the destructive action of highly abrasive materials such as ashes.

The heart of a centrifugal pump is the impeller, which must be correctly designed for the application. Two types of impellers are available for Amsco-Nagle pumps. For ash handling, where abrasive action is drastic, the



Class "D" impeller, recommended for ash handling pumps.

Class "D" impeller pictured is recommended. It has wide clearance between the shrouds, and the slippage seal is effected by means of the close clearances between the shrouds and the sides of the pump. Accordingly, slippage is kept at a minimum for long periods.

The design and materials of construction of Amsco-Nagle Pumps afford high ultimate economy in ash handling or other abrasive applications. Made in all sizes from 6″ to 16″. Write for latest literature.

Joliette Steel Limited, Joliette, Quebec, owned by American Brake Shoe Company, produces and sells Amsco Manganese Steel Castings in Canada.

AMSCO

Foundries at
Chicago Heights, Ill.; New Castle, Del.;
Denver, Colo.; Oakland, Calif.;
Los Angeles, Calif.; St. Louis, Mo.
Offices In Principal Cities

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS • ILLINOIS

AMERICAN Brake Shoe COMPANY

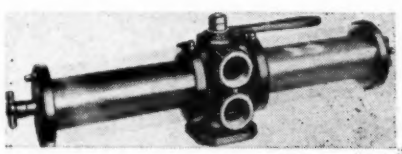
relays. These relays operate directly from secondary circuit of wound-rotor motor, and their operation is matched to induced rotor frequency, which is directly proportional to motor speed.

Controller panels are mounted on vertical angles to facilitate surface mounting against crane girders. Pivoted at bottom, panels can be tilted for access to rear-of-panel wiring. Hinge brackets on the side limit angle of tilt. General-purpose or gasketed inclosures are available for all panels. **Dept P, Electric Controller & Mfg Co, 2700 E 79th St, Cleveland 4, O.**

Torque Wrenches

FOUR MODELS of torque wrenches have been added to *Sensory* line: (1) Model S200 has capacity of 0 to 200 ftlb, calibrated in 5-ftlb steps. (2) Model S300 has capacity of 0 to 300 ftlb, in 10-ftlb steps (3) Model S2400-I has capacity of 0 to 2400 in lb, in 50-in.-lb steps. (4) Model S3600-I has capacity of 0 to 3600 in. lb. in 100-in.-lb. steps. These models are equipped with ¾-in. drive squares.

Sturtevant *Sensory* torque wrench permits measurement of pre-set torque by sight, sound and feel. When pre-set torque has been reached, *Sensory* mechanism sounds a loud and distinct click and imparts a definite strong impulse to hand. Applied torque can also be read on the dials, which are readable from all working angles. **Dept P, P A Sturtevant Co, Addison, Ill.**



Pipeline Strainer

TRANSPARENT LUCITE CASING permits visual inspection of pipeline strainer. Without disturbing strainer, operator can see whether strainer unit needs cleaning. If it does, flow can be diverted into other chamber, without loss of pressure, and filled chamber can be cleaned while pipeline maintains its normal flow.

Large open-area capacities afford free movement of fluids throughout unit; 16 to 1 ratio with 12-in. tubes and 8 to 1 ratio with 8-in. tubes. Flat, horizontal design makes this strainer particularly adaptable to low, close-quarter installations. Strainers are made with bronze bodies, handle, caps, tierods and nuts. Strainer baskets are available in brass, monel or other metal specified. **Dept P, J A Zurn Mfg Co, Erie, Pa.**

Solubridge Recorder

RP RECORDER continuously and permanently records electrolytic conductivity of solutions, condensates or water by *solubridge* method. *Solubridge* recorder incorporates an ac Wheatstone-bridge circuit operating on null-balance principle. The accuracy is consequently independent of line-voltage fluctuations and vacuum-tube characteristics. Instrument can be furnished for one, two, three or four continuous-line records

Going Up?

SURE, you can *walk* up, if you like. But you'll get there *faster* and *easier* by modern methods.

That goes for *solid fuels*, too. They can be carried from stock pile to boiler room by costly, old-fashioned methods. Or you can move them *faster*, *easier*, and *cheaper* by a modern Robins Conveyor System.

That's because Robins Conveyor Systems are "Job-Engineered"—built to fit the specific requirements of your particular job. And that's why operators the country over depend on Robins Conveyor Systems to help speed fuel-handling operations . . . with efficiency and economy!

So why not call in a Robins "Job-Engineer" to help solve *your* fuel-handling problem? A note or call will bring him to your desk for consultation. Of course, there's no cost or obligation for this service.

America's Only COMPLETE Materials Handling Service

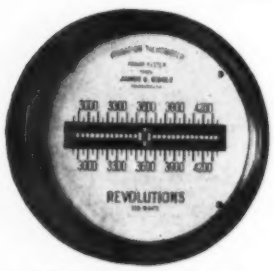
ROBINS
CONVEYORS INCORPORATED
PASSAIC, NEW JERSEY
DIVISION OF HEWITT-ROBINS INCORPORATED

Hewitt and Robins unite to offer you 136 years of combined experience in "Job-Engineered" rubber products and machinery designed best to answer any materials handling problem you may have.

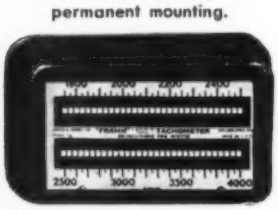
Using a hand type Frahm Tachometer on a Wright Cyclone aircraft engine.

EQUALLY DEPENDABLE
For Portable Use . . .
For Permanent Mounting

The "FRAHM" Vibrating Reed Tachometer



Frahm Tachometer, for permanent mounting.



Frahm Tachometer in splash-proof case for permanent mounting.

Frahm Tachometer, Miniature type.

Because the Frahm Tachometer requires no direct contact with the rotating part whose speed it is measuring, it can be used in practically any position and on almost any machine, large or small. Permanently mounted on or simply held against the machine, it gives the same dependable indications. It functions faithfully year after year. There are no delicate parts—no springs, jeweled bearings, pivots, weights, magnets or electrical connections—nothing except a set of steel reeds, accurately calibrated and suitably mounted.

Frahm Tachometers are furnished in both stationary and portable types, in round and rectangular cases and in many ranges from as low as 900 to as high as 100,000 rpm. For a description of these unique instruments, together with list of types and ranges commonly supplied, write for new Bulletin 1810-P.

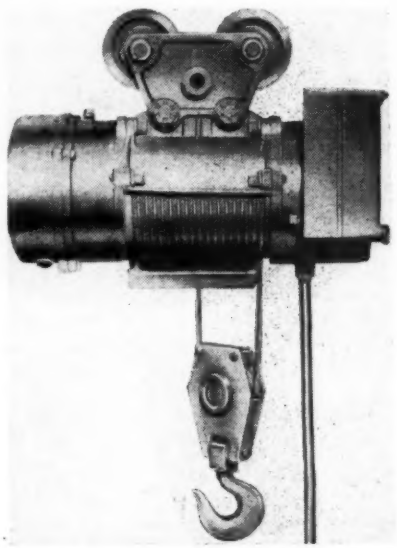
JAMES G. BIDDLE CO. • 1316 Arch Street Philadelphia 7, Pa.

on same 12-in. dia circular chart. Separate amplifier and motor-driven slide wire is used for each recording pen so no switching devices are necessary. All pens of a multiple-pen recorder may move at different times or simultaneously.

Numerous models of this RP recorder are available, covering either narrow or wide ranges and suitable with electrolytes of low or high conductivity. **Dept P, Industrial Instruments, Inc, 17 Pollock Ave, Jersey City 5, N. J.**

Enamel Remover

SYNTHETIC ENAMELS may be removed cleanly by wrinkling action of *Enthone* enamel stripper *S*-300. This new enamel stripper is said to remove alkyds, malamines and urea-formaldehyde coatings effectively with no damage to base metal. Phosphate coatings and anodized coatings are unharmed by this stripper which is applied full strength at room temperature. **Dept P, Enthone Co, New Haven 2, Conn.**



Electric Cable Hoist

BOB CAT ELECTRIC HOIST is made in three sections, permitting complete and easy access to any hoist part by removal of four bolts. Motor is entirely inclosed in drum, with patented heat-dissipation construction. Light weight and small size of this hoist are made possible by unique engineering design of internal mechanism Hoist is made of steel forgings and castings. **Dept P, Lisbon Hoist & Crane Co, Lisbon, O.**

Oil Conditioner

ORIGINALLY DESIGNED to provide full-flow filtration for Cummins diesel engines, Model No. 8-931-C oil conditioner serves on any heavy-duty gasoline or diesel engine with similar requirements. Oil conditioner is for engines of 150 to 250 hp. Containing eight Winslow elements with a total filtering area of 684 sq in., it has an oil capacity of 3¾ gal. The elements, when they are clean, permit a maximum efficient flow of 15 gpm with the oil at 140 F minimum.

Oil cannot drain back into crankcase when

Announcing the new RIDGID No. 4P Geared Threader for 2½" to 4" pipe

New ease of handling

New smoother, easier threading

New bother-free upkeep

New long life of efficient service

★

Quick-setting mistake-proof workholder

Loop handles make new 4P extra easy to put on pipe.

● Here's the new 2½" to 4" die stock you have been wanting. It's full of the work-saver advantages you expect of a RIDGID Pipe Tool.

Comfort-grip loop handles balance it easily—no slipping or tipping over. Easy to carry with one hand, easy to lift and put on pipe... RIDGID plate type workholder quickly sets to pipe size *before* you lift it, tightens on pipe with *one* screw—and no bushings to fool with or lose.

Easy upkeep, too—drive pinion shaft turns in oilless bronze bearing, never needs oil. Enclosed gear protects you, keeps out dirt. Drive pinion is solidly twin-anchored to face plate and gear housing; four sets of 5 high-speed steel chaser dies cut clean standard or tapered threads, drip threads, short nipples. RIDGID universal drive shaft available for power drive; ratchet handle with each threader.

It's RIDGID design and quality throughout—for great performance and durability. Write today for the whole story—see the new 4P at your Supply House.

Loop handles on gear cover for easy non-slip handling

★

Twin-anchored drive pinion-shaft turns in oilless bronze bearing

★

5 chaser dies

★

Fully enclosed gear

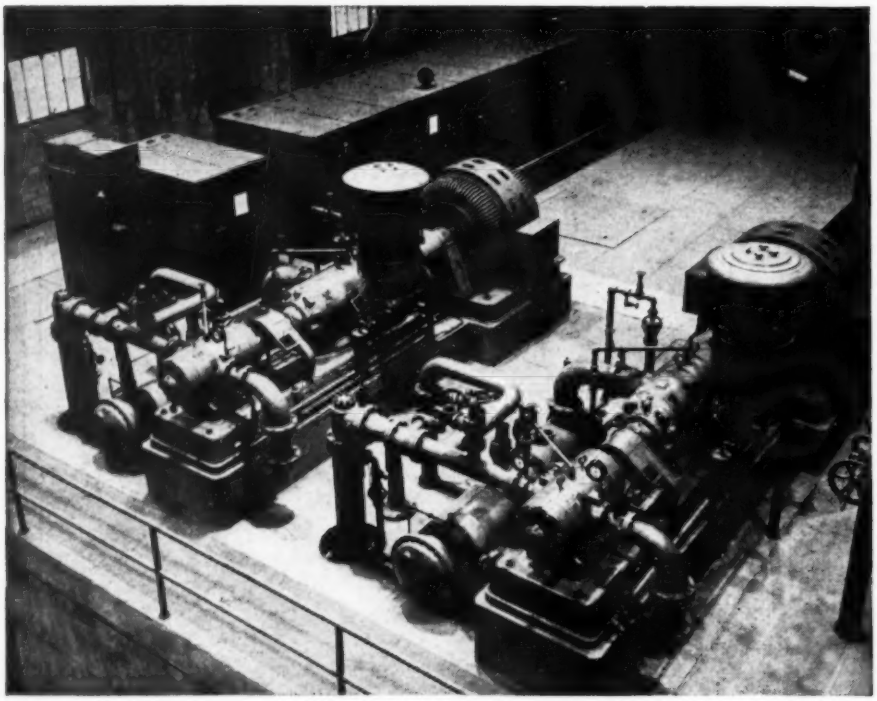
New 4P is extra easy to carry.

Millions of RIDGID Tools in use

★ RIDGID ★

WORK-SAVER PIPE TOOLS

The Ridge Tool Company
Elyria, Ohio, U. S. A.



28 Fuller Rotary Compressors Installed

Starting in June 1940, one of the larger steel companies purchased its first Fuller Rotary Compressor, and has continued this policy until at the close of 1944 they had purchased and installed 28 Fullers. Truly a very fine recommendation for these machines.

Installation illustrated above shows two of the two-stage compressors, each having a capacity of 1800 c.f.m. actual free-air delivery, at 125-lb. pressure. These machines furnish air for general plant use.

The capacity of machines installed range from a small 5-lb. to 50-lb. gas booster to the larger two-stage of 1800 c.f.m., 125-lb. pressure for general plant use. Most of them, however, are the larger two-stage type.

Fuller Rotaries will give you years of efficient service . . . we invite your inquiries and investigation. Write for Bulletin C-5, fully describing and illustrating these machines.

BUILT FOR CAPACITIES TO 1800 C.F.M. PRESSURES TO 125-LB. VACUUMS TO 29.90-IN. REFERRED TO 30-IN. BAROMETER — FULLER ROTARY COMPRESSORS AND VACUUM PUMPS

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

Chicago 3 - 1144 Marquette Bldg.
San Francisco 4 - 421 Chancery Bldg.
Washington 5, D. C. - 618 Colorado Bldg.

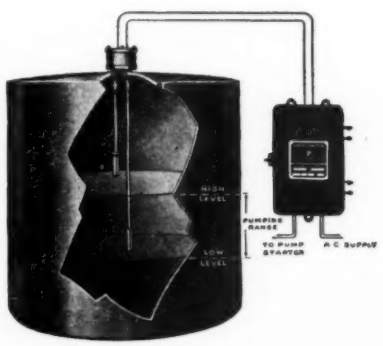
C-124

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

engine is idle. This means that filter will be full whenever engine is started, thereby eliminating any chance of a flooded crankcase. Another design feature is found in cover assembly. Four built-in bypasses, each with a free area equal to filter outlet, are constructed to prevent dirt building up on ball seat and holding bypasses open. **Dept P, Winslow Engrg Co, Oakland, Calif.**

Inch Converter

CALCULAIDE pocket-size plastic inch converter provides decimal equivalents of fractions of an inch, metric equivalents up to 100 mm, U. S. standard gage numbers and drill numbers. Inch converter is only 5¾ in. in dia, yet decimal equivalents are graduated in 0.001 in. and, according to maker, can be estimated to an accuracy better than one-five-thousandths of the range. Likewise, metric equivalents are graduated in 0.1 mm and can be estimated to 0.01 mm. Range is from 0 to 100 mm. U. S. standard gage sizes from No. 3 through No. 30 are provided. Drill numbers from No. 1 through No. 60 are also shown. **Dept P, American Hydromath Co, 145 W 57th St, New York, N. Y.**



Level Control

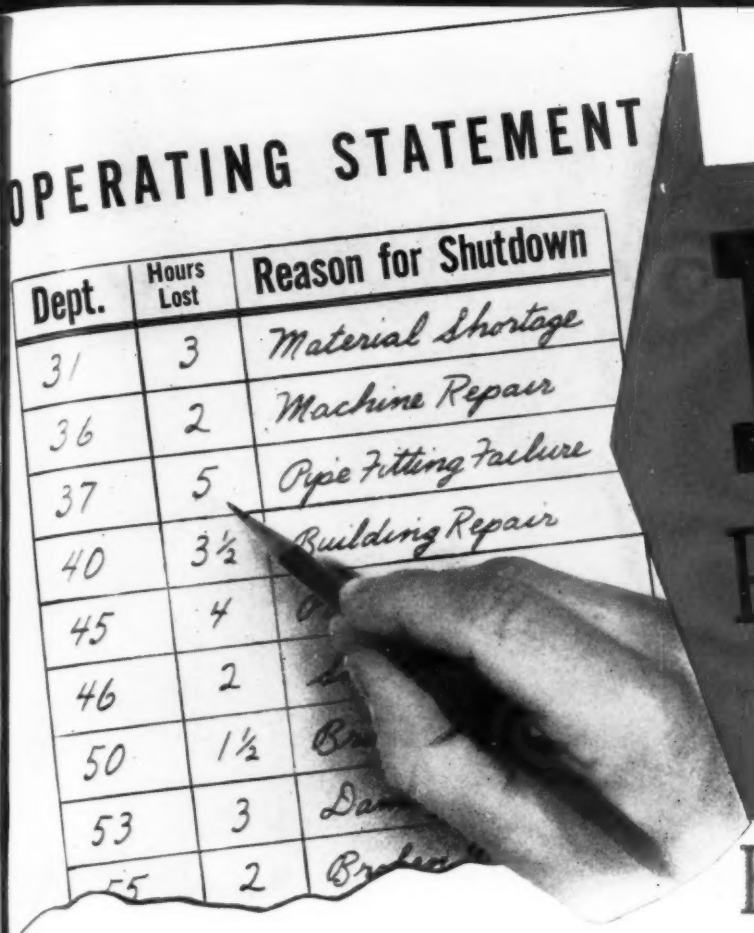
PHOTOSWITCH SERIES 10 level control makes available a series of rugged maintenance-free relays for level control of all electrically conductive liquids. Contact with liquid is made only by a stainless-steel probe rod. There are no floats, bellows, seals or stuffing boxes. With ac in probe circuit, no electrolytic action is possible. Mica-insulated probes insure against leakage. Control contains no vacuum tubes and operates with low voltage in probe circuit.

Specifications are as follows: Supply—115 or 230 v, 50/60 cycles ac; total power consumption ½ watt. Output—single pole, double-throw relay. Contacts are designed for motor starter, motorized or solenoid-valve operation. Arc suppression is supplied on both contacts for increased contact life. Probe circuit carries a resistance as high as 3500 ohms. **Dept P, Photoswitch Inc, 77 Broadway, Cambridge 42, Mass.**

Pipe Insulation

MYSTIK SELF-STIK DRI-PIPE permanently prevents condensation under warm, humid conditions by forming a sheathlike jacket around pipe. Installation is simplified because of *Self-Stik* edges on product with

(*Continued on page* 172)


OPERATING STATEMENT
Dept. | Hours Lost | Reason for Shutdown
31 | 3 | Material Shortage
36 | 2 | Machine Repair
37 | 5 | Pipe Fitting Failure
40 | 3½ | Building Repair
45 | 4
46 | 2
50 | 1½
53 | 3
55 | 2

LOST PRODUCTION TIME

that LADISH Forged Steel Fittings *would have prevented!*

Your best protection against shutdown losses from premature piping failures is the added strength and soundness of Ladish *Forged Steel* Fittings.

Their greater toughness to resist shocks, strains, stresses and erosion . . . their finer grain structure . . . and absence of concealed defects . . . result from the high impact pressures available only in the drop forging process.

Exacting metallurgical controls and rigid inspection of physical dimensions . . . inherent in Ladish Controlled Quality . . . further assure ultimate economy through years of trouble-free operation.

Write for your Ladish Forged Steel Fittings Catalog No. II.

TO MARK PROGRESS

Controlled Quality

FITTINGS DIVISION

LADISH DROP FORGE CO.

CUDAHY • WISCONSIN (MILWAUKEE SUBURB)

District Offices: NEW YORK • BUFFALO • PITTSBURGH • CLEVELAND • CHICAGO • ST. LOUIS • HOUSTON • NEW ORLEANS • LOS ANGELES

The Royal never needs adjustment

Because there's nothing to adjust

The ROYAL is the *only* Flush Valve which has no adjustment or regulation. Its simplicity of engineering design, *plus* precision manufacture, insure accurate and lasting performance.

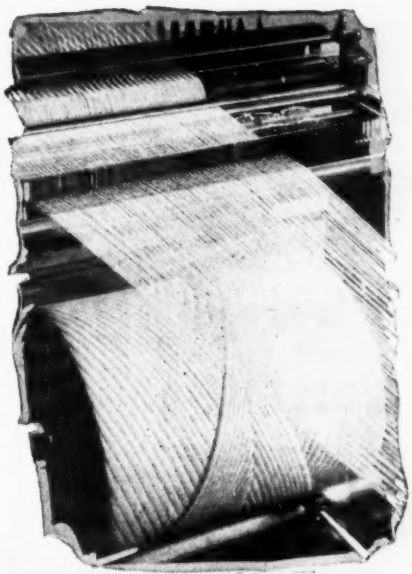
More than 4 million ROYAL Flush Valves are in daily service—including thousands of the first ROYALS installed over 36 years ago.

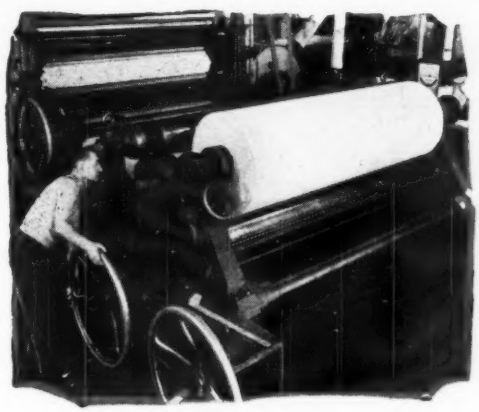
The ROYAL is "standard equipment" with discriminating builders and owners throughout the country. In fact, entire school systems, hotel chains, hospitals, industrial institutions, etc., use ROYALS exclusively.

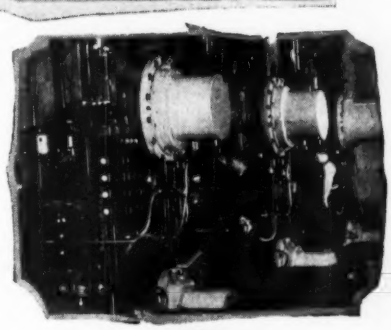
For the best in Flush Valves specify Sloan—remember, there are more Sloan Flush Valves sold than all other makes combined.

SLOAN VALVE COMPANY
4300 WEST LAKE STREET, CHICAGO 24, ILLINOIS

"Lowest Repair Bills in History"







. . . SINCE SWITCHING TO Tycol ENGINEERED LUBRICATION

"No sticking valves . . . negligible cylinder wear — with Tycol DIESEL OILS."

"Absence of sludge and corrosion . . . no wear on bearings — with Tycol RIO TURBINE OILS."

"Superior performance under high-temperature service — with Tycol STEAM CYLINDER OIL."

"Complete rust protection . . . corrosion eliminated — with Tycol NO-RUST-OLS."

"Maintenance costs cut 20% . . . since using Tycol E.P. Lubes."

That's how engineers and operating men express their satisfaction with the Tycol Industrial Oils and Greases they are using.

There's a Tycol oil and grease for every industrial need. For complete data on the Tycol lubricant best suited for your needs, get in touch with your nearest Tide Water Associated office today.

LUBRICATION—"ENGINEERED TO FIT THE JOB"

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Pittsburgh • Philadelphia

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

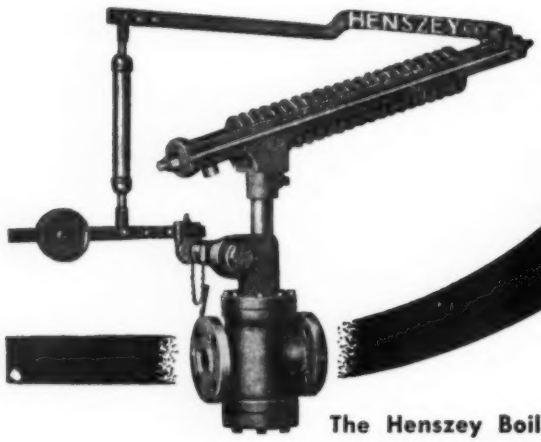
GOES RIGHT IN THE LINE . . .

The **HENSZEY**

BOILER FEED REGULATOR

offers

SIMPLE but EFFECTIVE BOILER WATER LEVEL CONTROL CONTINUOUSLY, AUTOMATICALLY, and ACCURATELY under ALL LOAD CONDITIONS . . .



The Henszey Boiler Feed Regulator is made for pressures up to 600 lbs. and in pipe sizes up to four inches. No additional structural supports are needed . . . once installed and set for operation, no further attention is necessary.

HENSZEY COMPANY, Dept. D8, Watertown, Wis.

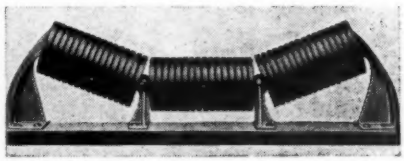
HENSZEY

BOILER FEED REGULATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

which it is fastened lengthwise to pipes. Job requires no technical knowledge, mechanical skill or experience. No tools other than a pair of scissors are needed.

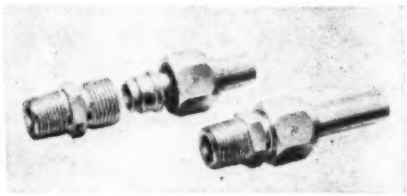
Once *Dri-Pipe* is installed, no painting or other covering is required. Its outer backing is a moistureproof resinous-coated cloth, which prevents dampness from damaging the soft-pliable insulating material. **Dept P, Mystik Adhesive Products Div, Chicago Show Printing Co, 2635 N Kildare Ave, Chicago 39, Ill.**



Troughing Idler

NEWLY DESIGNED REX STYLE NO. 35 impact-cushioning troughing idler is said to protect and greatly lengthen life of conveyor belt. Each roll consists of a rubber cylinder vulcanized directly to assembly tube. Cylinder has multiple grooves molded into it. It has deep primary grooves for maximum cushioning to guard against belt-carcass rupture and shallow secondary grooves to provide surface softness for protection against belt cover laceration.

For all loading conditions, cushion idler should be used to support belt directly under loading point. It is recommended that three to four units be utilized, spaced at one half the normal idler spacing. Each roll is equipped for high-pressure grease lubrication and is regularly furnished with a hydraulic fitting. Momentary displacement of rubber instantaneously absorbs energy of blow, thus dampening impact force. **Dept P, Chain Belt Co, 1600 W Bruce St, Milwaukee 4.**



Flareless Fitting

FITTING JOINS all kinds of metal tubing, including ¼ hard stainless steel, in hydraulic and fluid-conveying systems. Eliminating special flaring and assembly tools, brazing or soldering, new fitting incorporates a steel ferrule which, when body and inclosing nut are tightened up, acts to cut a shoulder in tubing itself, thus providing a strong, tight-sealing grasp for assembly. Fitting is ideal in high-pressure applications and where wall tubing is thick.

The three fitting units have been provided with a loose fit with tube size to be used, further promoting ease of assembly and permitting tube to center itself during makeup to facilitate a uniform depth of cut. Only tube preparations necessary are square cutoff and removal of burrs. Joints on which new fitting is used may be broken at any time without affecting resealability. This characteristic also permits the disas-

WHATEVER YOUR PIPING NEEDS

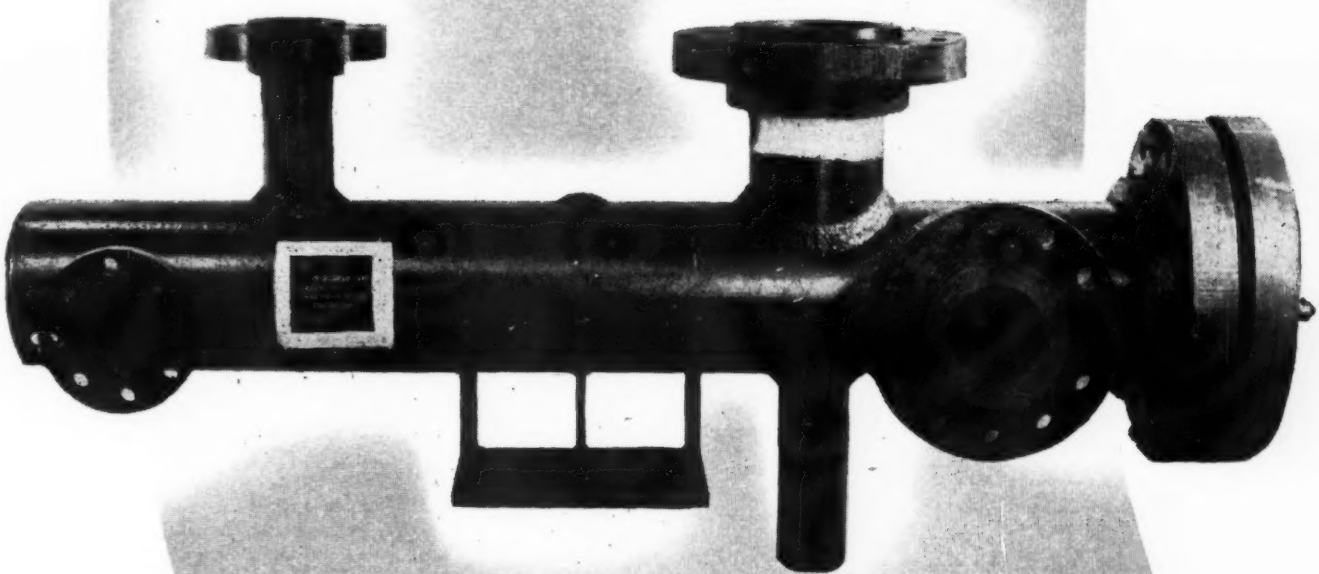
SHAW

can fill them Quickly - Dependably

KNOWN SINCE 1893 FOR HIGH-QUALITY

dependable **PIPING**

Pre-Fabrication & Installation



Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

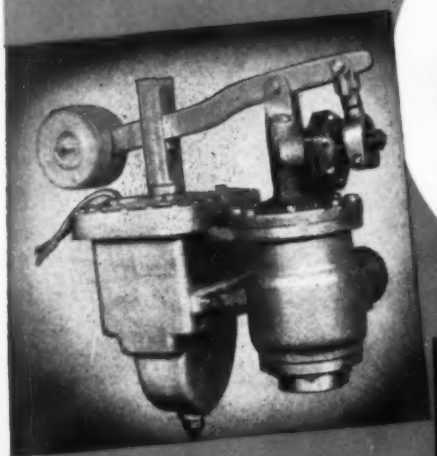
President

Benjamin F. Shaw Company

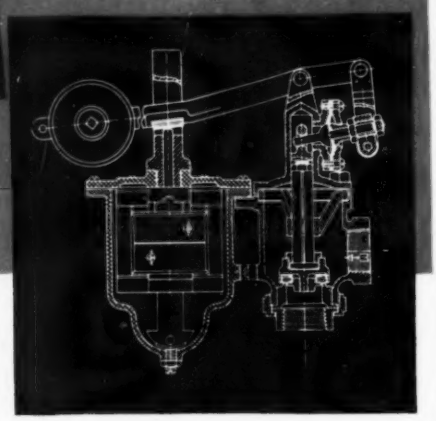
Second & Lombard Streets, Wilmington, Delaware

check the advanced features you get in

DAVIS SOLENOID VALVES



an example



• Don't confuse Davis industrial-type Solenoid Valves with ordinary low cost commercial types. Davis products are engineered to handle the "tough jobs" on a basis of SATISFACTION GUARANTEED. The Davis line is complete — standard and special designs are available for every conceivable kind of automatic control application.

Our Engineering Department is always ready to assist in solving any problems regarding the use of Solenoid Valves. When submitting your problem, give complete information so that the proper valve may be selected for the service. State size of valve, whether globe or angle pattern, nature of fluid or gas, temperature, maximum and minimum pressures, service for which valve is to be used, whether valve is to be open or closed when solenoid is energized, standard or explosion-proof solenoid box and current characteristics. DAVIS REGULATOR CO., 2540 S. Washtenaw Ave., Chicago, Ill.

No. 97 SL

✓ **Completely Sealed Valve Mechanism.** Valve stem is connected to solenoid lever through patented "DIA-BALL" packless joint. Widely favored for handling inflammable or toxic gases or liquids.

✓ **Self-Cleaning Design.** Can be used successfully for handling heavy, sticky materials because the valve interior is simple, port area large, and outlet downward, thus taking advantage of natural gravity flow. Note that valve seat is removable for cleaning merely by loosening union connection on bottom outlet.

✓ **Explosion-Proof Solenoid Housing.** Solenoid coils can be supplied for any current characteristics.

✓ **Renewable Valve Disc.** Supplied with composition or metal disc to suit particular requirements. Wide choice of materials available for valve and trim.

✓ **Visible Action.** Note that valve action is visible and can be tested by hand. In an emergency the valve can be manually operated.

DAVIS VALVES

DAVIS REGULATOR COMPANY

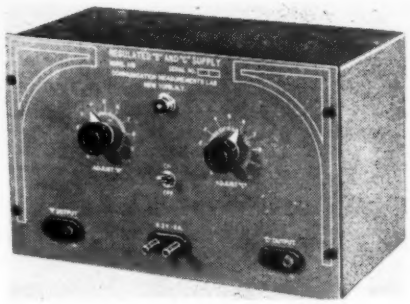
sembly of any joint before final assembly for visual inspection of quality of gripping cut. To be available initially in ¼- and 1-in. OD tube sizes, in all conventional shapes and materials, fittings will be threaded identically in size and pitch with corresponding flared fitting. **Dept. P, Parker-Appliance Co, Cleveland, O.**

Mill-Feed Control

GAI-TROL MILL-FEED CONTROL improves efficiency, output and performance, according to maker, of tube, ball, bowl and other grinding mills. In power plants employing pulverized coal for direct firing, its use is said to result in an increase in boiler efficiency.

Equipment consists essentially of a load detector, external to mill and connected directly to electronic equipment which is contained in a 66-in.-high floor-mounted self-supporting steel cabinet. A circuit from electronic equipment in this cabinet supplies a variable-speed, dc, feeder-drive motor.

Circuit between load detector and feeder is direct and entirely electronic. No relays, moving parts or mechanical speed-change equipment are involved. **Dept P, Gai-Tronics Corp, 1417 K St, N W, Washington, D. C.**



Dual-Power Supply

TWO INDEPENDENT, regulated power sources are combined in the *CML* 1115 dual-power supply. The *B* supply furnishes a continuously variable dc voltage from 180 to 300 v, at 70 ma, with a maximum ripple of less than 25 mv. Negative side of the supply is isolated from chassis, so the + *B* may be grounded if it is desired to use the supply as a source of grid bias for tubes that draw heavy grid current. A continuously variable dc voltage from 0 to 75 v with less than 7-mv ripple is furnished by the *C* supply.

Panel controls adjust output voltages throughout ranges indicated. Independently insulated panel connectors are provided for high-voltage terminals. Panel binding posts are supplied for connection to a 6.3-v 2-amp unregulated ac filament supply. An ac power switch and pilot light are also mounted on front panel. **Dept P, Communication Measurements Laboratory, 120 Greenwich St, New York, N. Y.**

Adjustable Circle Cutters

UNIQUE TOOL quickly cuts smooth large-sized holes in wood, steel, brass, hard rubber, aluminum, fiber, plastics and problem material that might necessitate use of torches or

What is it?

That's what everybody says upon seeing this picture for the first time. The photograph was taken in the plant of a large, nationally-known drug manufacturer and the odd-looking objects are tumbling barrels in which pills receive their sugar coating!

Furnishing the power to keep the tumblers tumbling are 5 H.P. Master Triple Parallel Gearmotors equipped with Timken Tapered Roller Bearings. This is one of the more unusual applications of Master Gearmotors. They are used for hundreds of different purposes in scores of different industries in sizes ranging from 1/10 to 100 H.P.—Timken Bearing Equipped.

For eighteen years the Master Electric Company, Dayton, Ohio has used Timken Bearings on the gear shafts of these Gearmotors and found them equal to every demand in speed and load capacity —radial loads, thrust loads and both together in any combination. They also hold moving parts in constant alignment, increase endurance; reduce maintenance.

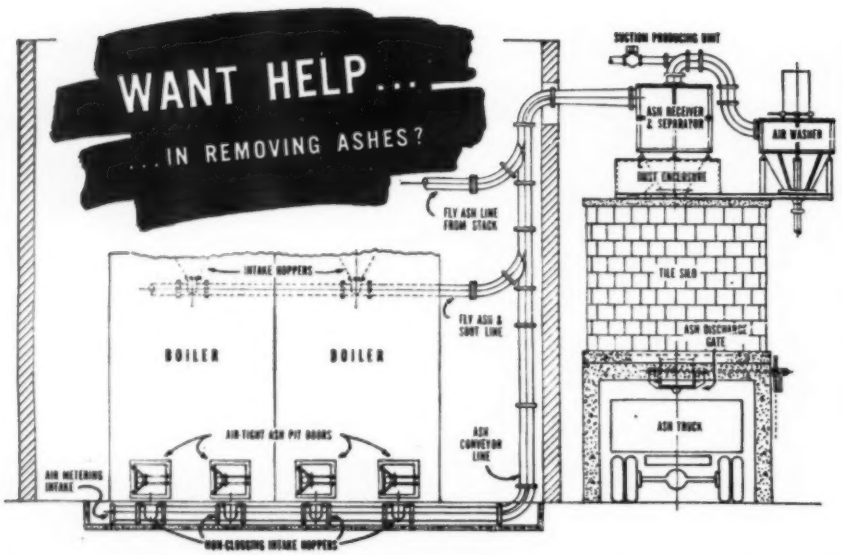
When buying bearings for your equipment; look for the trademark "TIMKEN" stamped on every bearing; then you'll be sure of getting tapered roller bearing performance at its peak. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN BEARING EQUIPPED

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



Get the help you need by installing a Beaumont Birch "Vac-Veyor" pneumatic ash handling system. Labor is saved; cleanliness effected. System time-tested. Low first cost. Low operating cost. Installation as flexible as running a pipe line. Two sizes, two types—for delivering ashes either dry or damp.

For details—write!

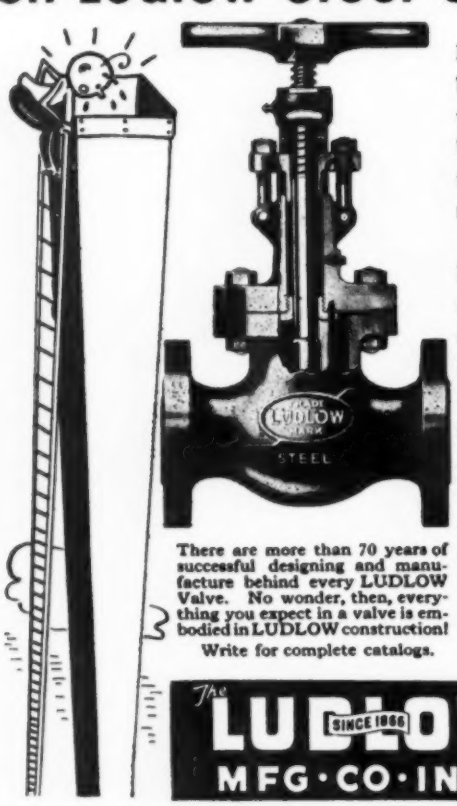
BEAUMONT BIRCH COMPANY

1502 RACE STREET PHILADELPHIA 2, PA.

DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS

DEEP PACKING BOX...

on Ludlow Steel Globe Valves



It means a lot to know less time can be charged to "repacking." That's why LUDLOW Steel Globe Valves have become such a favorite with top-notch engineers and maintenance men.

They know they can depend on LUDLOW to produce valves that are efficient . . . long-lasting . . . dependable. And, they go for the LUDLOW "Plus" features . . . the exceptionally deep packing box that keeps maintenance and replacement at a minimum . . . the two yoke shelves that hold the follower out of the way while repacking . . . the follower bolts of swing hinge-eye type that make for easier repacking whenever necessary.

There are more than 70 years of successful designing and manufacture behind every LUDLOW Valve. No wonder, then, everything you expect in a valve is embodied in LUDLOW construction!

Write for complete catalogs.

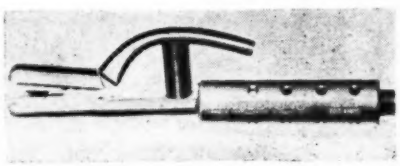
V-5

The **LUDLOW VALVE** SINCE 1866

MFG·CO·INC·TROY·N·Y·

other expensive equipment. **Bruno** adjustable circle cutter cuts holes to any diameter from $1\frac{7}{8}$ to 8 in. through $\frac{1}{4}$ in. thickness in steel or other tough metals, and any thickness up to $1\frac{1}{2}$ in. in plastics, fiber or wood. Tool operates in any standard drill press, woodworking machine or suitably mounted spindle machine.

Bruno adjustable circle cutter consists of a combination drill and pilot with an improved high-speed cutting blade, adjustable to depth and diameter. *Wedge-lok* cutting-blade holder permits cutting edge to recede or yield from work while still maintaining steady pressure and feed. Cutting blade is easily resharpened without special tools by grinding on one edge only. Twin-blade holder (fixed $\frac{1}{2}$-in. center) cuts washers, wheels, disks and gaskets in one operation. **Dept P, Bruno Tools, Beverly Hills, Calif.**



Electrode Holders

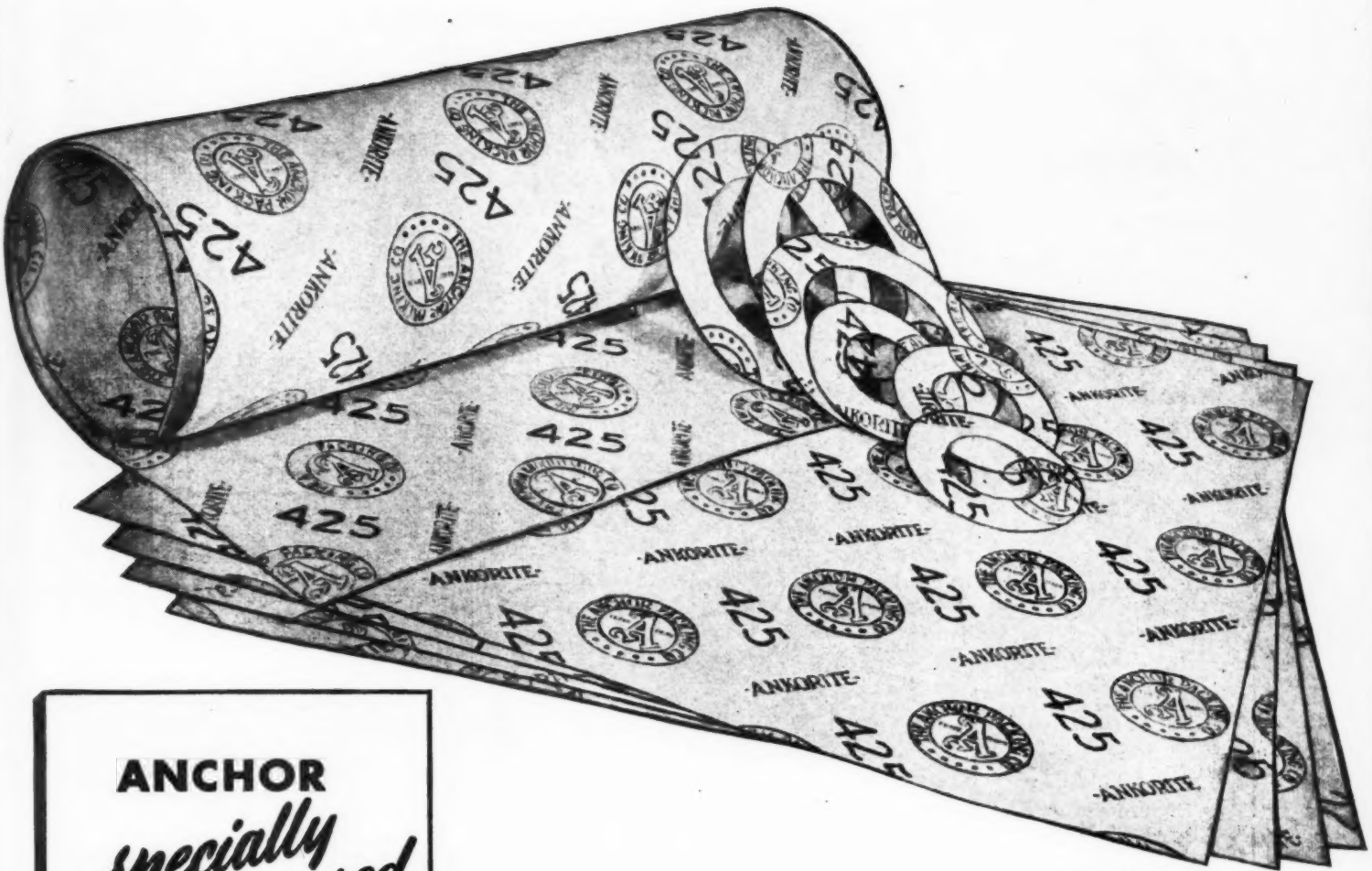
TWECOTONG MANUAL ARC-WELDING electrode holder line includes full-insulated and semi-insulated models. Full-insulated models are known as No. A-14, 300 amp, $\frac{1}{4}$-in. electrode capacity; No. A-38, 500 amp, $\frac{3}{8}$-in. electrode capacity. Semi-insulated models are known as B-14, 300 amp, $\frac{1}{4}$-in. electrode capacity; No. B-38, 500 amp, $\frac{3}{8}$-in. electrode capacity.

Twecotong is a conventional tong holder. However, it is said to feature almost indestructible molded-laminated glass cloth *Bakelite* insulation keyed to holder casting. Tensioning spring firmly seats on fiber upset washers and is protected from spatter by nonbinding *Neoprene* tubing. Well-ventilated fiber handle, together with good cable connection, assures a cool running holder. All parts are replaceable. **Dept P, Tweco Products Co, English at Ida, Wichita 7, Kan.**

High-Speed Diesels

TWO ENGINES have been added to Cummins-marine diesel line. The high-speed diesels are Model *NHM*-600, with a maximum rating of 200 hp at 2100 rpm, and supercharged Model *NHMS*-600, rated at 275 hp (max) at 2100 rpm. Both were developed from Series *H* and supercharged *HS*, 6-cylinder diesels.

Increased capacities of the newly developed diesels were obtained by these three major innovations in the established Cummins design: (1) Maximum operating speed was increased from 1800 rpm (Models *HM* and *HMS*) to 2100 rpm (Models *NHM* and *NHMS*). (2) Size of bore was increased from $4\frac{7}{8}$ to $5\frac{1}{8}$ in., with corresponding increase in piston displacement from 672 to 743 cu in. (3) Dual-intake valves increase air supply needed to assure efficient combustion of the additional fuel required to produce increased hp. Dual-exhaust valves permit rapid exhausting of gases from combustion chamber. **Dept P. Cummins Engine Co. Columbus, Ind.**



ANCHOR *specially processed* ASBESTOS SHEET

. . . WITHSTANDS HIGH PRESSURES AND TEMPERATURES

A cream colored compressed asbestos sheet manufactured with great care from long fiber Canadian asbestos. Through a special process, a refined mineral pigment with high heat and age resisting qualities is combined with the asbestos fiber and "felted" into laminated form under heavy pressure, to produce the finished sheet. This sheet is homogeneous and may be depended upon for high pressures and temperatures.

Sizes from $\frac{1}{64}$" to $\frac{1}{8}$" in sheets 50" x 50", 50" x 150", 60" x 60", 75" x 150", 150" x 150" or multiples thereof.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

BRANCH OFFICES

Baltimore 2, Maryland	106 Stewart Bldg., Gay and Lombard Streets
Boston 14, Massachusetts	303-04 North Station Building 150 Causeway Street
Buffalo 2, New York	Andrews Building
Cleveland 13, Ohio	523-25-27 Rockefeller Building
Columbus 9, Ohio	172 North Cassingham Road
Chicago 11, Illinois	230 East Ohio Street
Cincinnati 2, Ohio	4 West 7th Street
Detroit 26, Michigan	169 West Jefferson Avenue
Houston 2, Texas	509 Washington Avenue
Kansas City 6, Missouri	1332 Oak Street
Los Angeles 21, California	720 Mateo Street
Montreal 20, Canada	5575 Cote Saint Paul Road
Milwaukee 2, Wisconsin	903 East Kilbourn Avenue
New Orleans 4, Louisiana	418 Common Street
New York 13, New York	100 Sixth Avenue, near Canal
Philadelphia 8, Pennsylvania	401 North Broad Street
Pittsburgh 22, Pennsylvania	405 Penn Avenue
Portland 1, Oregon	1433 S. W. Front Avenue
San Francisco 7, California	156 South Park
Seattle 4, Washington	2207 First Avenue, South
St. Louis 3, Missouri	1407 Pine Street
Tulsa 4, Oklahoma	823 South Gary Place
Wilmington, California	524 North Avalon Boulevard

RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO

Medium volatile, high fusion coking coal for by-product and steam use from Wyoming Co., W. Va., on Virginian Ry.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

CHARMCO

Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

General Coal Company

123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.

BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI DETROIT NEW YORK NORFOLK PITTSBURGH

Power News

(*Continued from page* 124)

the high-efficiency unit shown will occupy an actual area of about 4500 sq ft. Another advantage, likely to make the gas turbine a choice over steam units in certain power-generation applications in the future, is its ability to operate without great quantities of cooling water needed for steam plants. Standby applications are also said to appear promising.

The trim-looking model, made of wood, metal and plastics from dozens of detailed drawings, was built by Brooks Stevens, well-known industrial designer.

Manhattan District Project of the Army Engineers, which developed the atomic bomb, has ordered a 100,000,000-v atom-smashing X-ray machine from General Electric Co. The machine is being obtained by the Clinton Laboratory at Oak Ridge, Tenn., which is operated by Monsanto Chemical Co for the Manhattan District Project. Major General Leslie R Groves, head of the atomic bomb project, inspected the GE Research Laboratory's facilities for atomic research a short time ago. He evidenced special interest in the 100,000,000-electron-volt machine, known as a *Betatron*, which generates world's most powerful X-rays and radiation for laboratory application.

Detailed procedures for nationwide release to institutional and industrial research laboratories of radioactive isotopes produced from uranium chain-reaction piles were announced by Manhattan District, developer of the atomic bomb. More than 100 radioisotopes will be made available in varying quantities under the program set up, the most promising being Carbon 14, Sulphur 35, Phosphorus 32 and Iodine 131. The radioisotopes will be released at this time only for research, not commercial, application in physics, chemistry, metallurgy and medicine. Distribution will be on basis of "out-of-pocket" cost to the government. Applications for quantities must be sent to Dr Paul C Aebersold, head of Manhattan District's newly established isotopes branch. They will be filled on a priorities basis, with attention paid to the use to which the materials will be put and amount of material available.

An 18,000-kva steam plant to supply electricity and industrial heating in the "port" section of Cambridge, Mass., is scheduled for construction by Cambridge Electric Light Co in the vicinity of the Broad Canal and lower Charles River basin. Two boilers, of 200,000-lb-per-hr capacity at 1450 psi and 900 F each, and an extraction turbine-generator are planned initially. The plant will be tied into the present Blackstone St station by feeders, as well as interconnected with Boston Edison system. New England Gas & Electric Service Corp, Cambridge, Mass., is handling engineering for the new plant.

KELLOGG

Solves the Most Complex Piping Design Problems Scientifically

The Kellogg Scientific Method of Determining Moments and Forces Electrically, by the use of a scale model testing apparatus, capable of measuring load deflections to one millionth of an inch, has solved many complex and highly specialized pressure and temperature problems.

This scientific design research is available to consulting, power, process and marine engineers.

Write today for copy of bulletin "Analyzing Piping Stresses by Tests of Models."

KELLOGG

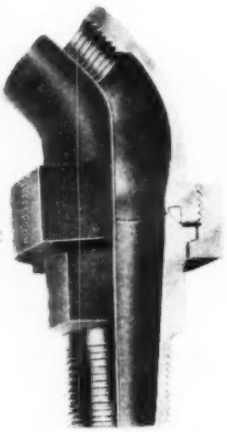
"Masterflex" Prefabricated Piping Systems · "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · JUIK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY · JERSEY CITY, NEW JERSEY · 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

LOS ANGELES: 609 SOUTH GRAND · HOUSTON 2, TEXAS: 402 ESPERSON BLDG. · TULSA: PHILTOWER BLDG.

JEFFERSON
Specialty
UNIONS
with the RECESSED BRASS SEAT



Jefferson 45° Male-Female Union Elbow which takes the place of a straight union, nipple and 45° elbow, thereby saving two pipe joints. Made also in All-Female type.

Save time, space and money on unusual piping jobs . . .

The use of Jefferson Specialty Unions . . 45° and 90° elbows and tees . . make it possible to save pipe joints, simplify piping installations and assure better jobs at lower cost.

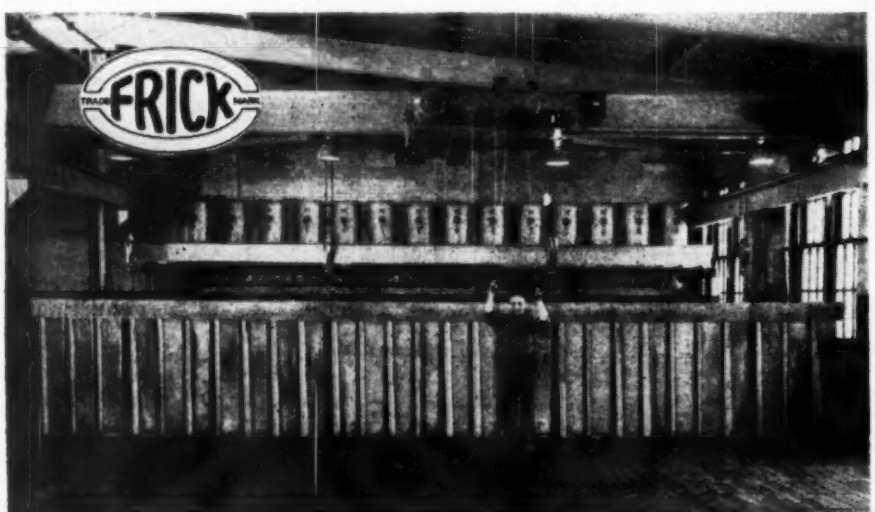
All Jefferson Unions, standard or Specialty, are built around the recessed brass seat, a tried and proved feature which is distinctive and exclusive with "Jefferson". This seat effects a joint which is absolutely leak-tight without excessive wrench pressure. By recessing the seat, straight through, uninterrupted flow is assured through the joint and pipe ends cannot come in contact with the seat regardless of how far they are threaded into the union.

JEFFERSON UNION COMPANY

601 W. 26th St., New York 1, N. Y.

Lexington 72, Mass. Lockport, N. Y.

Consult your nearest distributor on your requirements or get in touch direct with us for any information you need.



One-Man Ice-Making System Breaks Record!

The semi-automatic plant of the Polar Ice and Fuel Company, at Indianapolis, has completed a record run of over 500 days in which 42 tons of ice were made every day by ONE MAN. We believe no ice plant ever achieved such a volume of steady production before with only ONE MAN, working ONE SHIFT. This plant did it—and is still doing it—with Frick Refrigeration and Frick Ice-making Equipment. For full details write:

Frick Company, Waynesboro, Pennsylvania

ASME Nominates Officers For Coming Election

Eugene W O'Brien, vice-president of W R C Smith Publishing Co, Atlanta, Ga., has been nominated as next president of American Society of Mechanical Engineers. Five regional vice-presidents representing various sections of the country and four directors-at-large also were nominated. Election of the nominees will be held by letter ballot of the entire ASME membership of over 21,000 this coming fall, with ballot closing on Sept 24. New officers will take office late this year.

Regional vice-presidents named are the following: (1) Alton C Chick, assistant vice-president of Manufacturers Mutual Fire Insurance Co, Providence, R. I., renominated from region 1 for one year. (2) A R Mumford, development engineer with Combustion Engrg Co, 200 Madison Ave, New York, N. Y., newly nominated from region 2 for two years. (3) E E Williams, general superintendent of steam plants, Duke Power Co, Charlotte, N. C., renominated from region 4 for two years. (4) T S McEwan, vice-president, McClure, Hadden and Ortman, Inc, Chicago, Ill., renominated from region 6 for two years. (5) Linn Helander, professor and head of dept of mechanical engineering, Kansas State College, Manhattan, Kan., renominated from region 8 for two years.

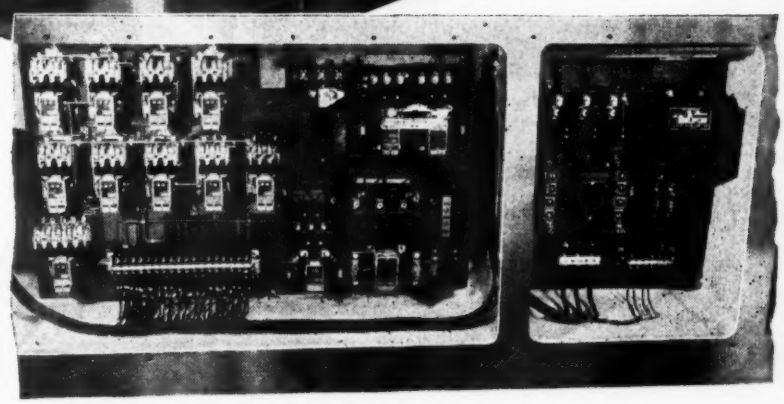
Directors-at-large named are: (1) F S Blackall Jr, president and treasurer of Taft-Peirce Mfg Co, Woonsocket, R. I., for four years. (2) B V E Nordberg, executive engineer, Nordberg Mfg Co, Milwaukee, Wis., for four years. (3) L F Moody, professor of hydraulic engineering, Princeton University, for two years. (4) W A Carter, technical engineer of power plants, Detroit Edison Co, Detroit, for two years.

Federal Power Commission has authorized, by order and Opinion No. 134, El Paso Natural Gas Co of El Paso, Tex., and Southern California Gas Co and Southern Counties Gas Co of California, of Los Angeles, to construct and operate facilities, including about 1200 miles of interconnected pipelines, to transport natural gas from Tex. and N. M. gas fields to markets in the Los Angeles area. The pipeline facilities are designed to meet a developing shortage in local natural gas supply for 3½ million persons in southern California. Cost of project is estimated at $70,000,000.

New addition to Drumheller power plant of Canadian Utilities Ltd has been started. The $600,000 addition will more than double capacity of plant. No date has been set for completion.

James F Lincoln Arc Welding Foundation is sponsoring a $200,000 Design-for-Progress Award Program. Its objective is to encourage study of welded design, research, application and use of arc welding through preparation and writing of papers. Papers are to be mailed not later than June 1, 1947. Copies of booklet describing rules and conditions of the award program are available on request to *James F Lincoln Arc Welding Foundation, Cleveland* 1, *O.*

Outstanding Control for Outstanding Machines



Built by LANDIS TOOL for the automotive industry, this 50,500 pound grinding machine provides the fastest known method of grinding crank shaft line bearings. Square D control (at right) puts this machine through its paces by "finger tip" operation.

You'll find SQUARE D CONTROL on machine tools of America's outstanding builders. They value the counsel of Square D Field Engineers and the sound engineering built into an unusually complete line of control units and accessories.

SQUARE D COMPANY

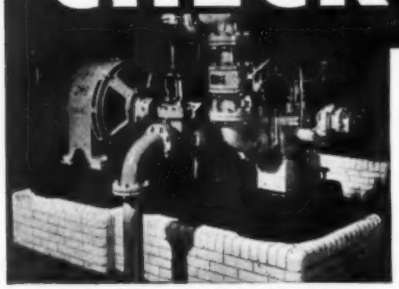
DETROIT • MILWAUKEE • LOS ANGELES

THIS NEW INFORMATIVE CATALOG WILL SOLVE YOUR "WATER HAMMER" *Problem!*

WILLIAMS-HAGER

FLANGED *Silent*

CHECK VALVES



A Williams-Hager Valve in the Metropolitan Life Building, New York.

- *Precision Engineered*
- *Economical*
- *Efficient*
- *Frictionless*
- *Tight Under Every Operating Condition or Pressure up to 6000 Lbs.*

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provide uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, air, salt water, brine, etc., regardless of temperature.

Write today for YOUR copy!

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

2055 Pennsylvania Ave. Pittsburgh, 12, Pa.

VIENNA *(McGraw-Hill World News)*: Nationalization of Austrian power-producing facilities is proposed in a reorganization plan submitted to the Cabinet Council by Ministry of Power. Public corporations, operated by the provincial governments, would be set up to meet provincial requirements and an inter-provincial corporation would be run by the central government. Austria is reported fairly well off in regard to generating facilities, even now "exporting" 900,000,000 kwhr annually. It is anticipated that when the nation's hydroelectric facilities are fully expanded enough power can be exported to pay for all food imports.

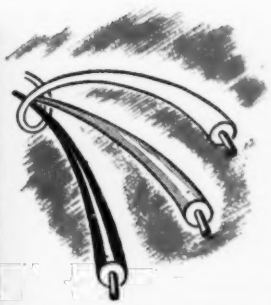
MONTEVIDEO, URUGUAY *(McGraw-Hill World News)*: An era of industrial and agricultural development is anticipated in this country as the great Rio Negro hydroelectric project at Rincon del Bonete moves rapidly towards its completion. The second of four generating units at the dam has just been placed in operation; the third is to be installed next March and the last by Dec 1947. With the project completed Montevideo will be drawing about 475,000,000 kwhr annually from it over 150-mi transmission lines, two of which already are in service. Total energy available to Montevideo area from all plants will be 537,000,000 kwhr annually. The lines from Rincon del Bonete will be hooked into the city's existing power grid, supplying cities in an 80-mi. radius. Work on the project was started in 1937 with a German syndicate as builders, but the Uruguayan government took over when war broke out. At that time the dam was 90% complete but the powerhouse had not been built.

MEXICO, D. F. *(McGraw-Hill World News)*: Gustavo P Serrano, Mexican secretary of national economy, recently declared that last parts for the second unit of the Ixtapantongo (state of Mexico) hydroelectric plant had finally arrived in Mexico from the U. S. This second 40,000-hp unit will probably start functioning toward the end of the present year. In conjunction with the first unit, already operating, the plant will then produce some 300 million kwhr per yr. The Ixtapantongo plant, the largest plant built by the Federal Electrical Commission, is mainly intended to fill needs of the Federal District (Mexico City and surroundings), the most industrialized area of the republic. When completed, the project will cost about 100,000,000 pesos ($20,000,000) and will be composed of three generating units.

Latest development in the joint standardization program of National Bureau of Standards and Industrial Mineral Wool Institute is release of Commercial Standard CS-131-46 on testing and reporting of all forms of mineral wool insulation. The tests described cover all material of fibrous form processed from molten rock, slag or glass. Forms of industrial mineral wool for which test methods are given are blanket, block, board, felt, granulated, industrial batt, insulating cement, loose, and pipe insulation of both blanket and molded forms. Copies of Standard CS-131-46 are available on request to *Industrial Mineral Wool Institute*, 441 *Lexington Ave, New York* 17, *N. Y.*

FLAMENOL CABLE

for wiring that's EASY TO IDENTIFY — HARD TO HURT



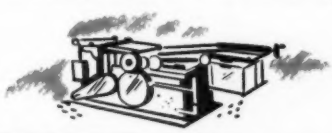
Electric circuits on machines, panelboards, control devices and the like are easily traced and identified when wired with Flamenol Cable. The smooth, impervious insulation of Flamenol *stays* bright and clean. Seven colors provide for permanent coding of complex circuits.

Once wired with Flamenol, electric circuits are well protected for the full life-span of the machine. All the usual causes of insulation damage have little if any effect on the insulation of Flamenol, as these actual cases show:

OIL WON'T HURT IT—In a chemical process plant, leads to oil-immersed motor controls were a constant source of trouble, until rewired with Flamenol. They've never given trouble since.

MILD ACIDS AND ALKALIES WON'T HURT IT—Used to wire a battery-charging set-up, Flamenol didn't fail despite "dunking" with electrolyte. In paper-mill wiring, it stood up against alkalies.

SOLVENTS WON'T HURT IT—Flamenol ended wiring troubles on printing presses where inks splashed on the wiring.



MOISTURE WON'T HURT IT—After 7 years underground in damp soil, Flamenol insulation was still impervious.

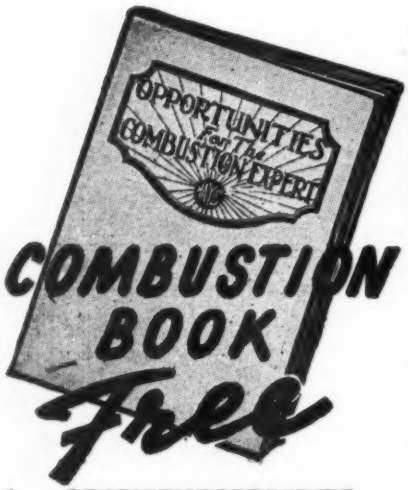
AGE WON'T HURT IT—In a seven-year test under Florida sunlight, the insulation on Flamenol cable showed no signs of deterioration.

ANOTHER G-E ACHIEVEMENT RESULTING FROM "FULL-RANGE" RESEARCH

Long before the rubber shortage, G.E. had been seeking a "better-than-rubber" insulation for low-voltage wire and cable; an insulation that would be slow to age, hard to burn, and able to resist acids, oils, water, and alkalies. Soon, chemists in the G-E laboratories produced such an insulation from plasticized polyvinyl chloride. G-E process engineers then took the new insulation, and prior to 1936 had solved the problem of its application to a conductor on a practical basis. The result was Flamenol, the first wire and cable to be insulated with long-lived, tough, plasticized polyvinyl chloride—another G-E first. ***Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

502-58-1200



LEARN THE SECRET OF BIG EARNINGS IN

COMBUSTION ENGINEERING

There are plenty of big jobs today in Combustion Engineering. Such jobs have always been big pay jobs—and today they are better than ever. High fuel and equipment costs means a greater demand for combustion trained men than ever before.

Do you want such a job? You can have it—if you will train for it. And that is *easy to do.* Just a little of your spare time is required for the simple, easy-reading, practical Hays Home Study Course in Fuel and Combustion engineering.

A few of our friends whose employees have advanced through Hays training:
- International Harvester Co.
- Armour & Co.
- Combustion Engineering Co.
- Riley Stoker Corp.
- Iron Fireman Mfg. Co.
- Commonwealth Edison Co.
- State of Illinois Cities Service (Oil & Power)

and many others.

For 28 years we have specialized exclusively in such training. Today, Hays trained men are more in demand than ever. Now is the time to do what hundreds of others have done who hold substantial positions of responsibility today.

Write for Free Book Now!
Don't Delay! Mail Coupon Today!

You can't lose by getting the facts. We'll send our book, "Opportunities for the Combustion Expert" without obligation or expense to you. Learn how every lesson is administered by trained practical staff men who give the utmost in help and guidance. Get complete outline of course. Learn how to become a key man in Combustion. Send in the coupon now!

Hays Institute of Combustion
430 N. Michigan Ave., Chicago 11, Ill.
Dept. 18
Our 28th Consecutive Year

HAYS INSTITUTE OF COMBUSTION
430 N. Michigan Ave., Chicago 11, Ill.
Dept. 18

Please send me your Free Book "Opportunities for the Combustion Expert"—No obligation.

Name.....

Address.....

City..... State.....

Company Name.....

Preliminary work upon the most northern of its size hydroelectric plant on American continent is under way, directed by W G Stuart, hydraulic engineer for Giant Yellowknife Gold Mines, with expectation that power will be available in 1948. Cost of the plant, which is estimated at around $4,000,000, will be met by the Dominion Government, while Giant Yellowknife will finance construction of the transmission line, at estimated cost of between $800,000 and $900,000.

American Standards Association announced publication of its 1945-46 Year Book. This book gives information about officers and members of board of directors, standards council and other policy-forming committees of the American Standards Association. It also carries such basic documents as constitution and bylaws of the ASA and much information about the setup of the organization and how standards are developed. Center section is devoted to a listing of approved American Standards and projects under development, together with scopes of these projects and names of officers and members of active technical committees. Copies of the Year Book are available on request to *American Standards Association, 70 E 45th St, New York 17, New York.*

Federal Power Commission has received from Big Inch Gas Inc an application for authority to construct the necessary conversion facilities and to operate the Big Inch pipeline to transport natural gas to markets in N. Y., N. J. and eastern Pa. Application states that the offer to War Assets Corp of $40,000,000 for the Big Inch is made with an offer of Big Inch Oil Inc to purchase the Little Big Inch for transportation of petroleum products.

SHANGHAI (*McGraw-Hill World News*): Plans for taking over and expanding power plants built in North China by the Japanese and possibilities of harnessing the Yellow River for generating purposes have been outlined by Dr Wong Wen-hao, minister of Economic Affairs.

North Hopeh Power Co is being set up to take over the plants at Shihtsing mountain, near Peiping, at Tientsin and at Pangshan. The Shihtsing facility, only half completed by the Japs, will have a capacity of 50,000 kw, and Pangshan, which now has a 15,000-kw capacity, has facilities totaling 25,000 additional kw still unfinished. When all three are fully developed they will have a total capacity of 100,000 kw, still far below the 300,000 kw needed to operate all the area's factories.

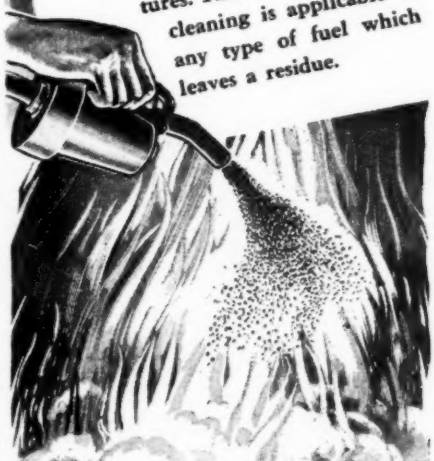
Likewise, plants built by Japs at Tsingtao and Changtien in Shantung province, at Shihchwang in Kiangsu, and at Tatung and Taiyuan in Shansi, are being taken over.

Discussing possibilities of developing Yellow River, Dr Wong said that eleven plants, the largest with a capacity of 8,000,000 kw, are being planned. He cited suitability of the middle valley of the river, where it drops more than 2200 ft between Suiyan and Nengtsing.

Dams built for the power plants would provide the additional benefit of preventing floods, besides opening up power to exploit the mines of Shantung province, he said.

XZIT REMOVES SOOT *chemically*

WHILE BOILERS OPERATE, XZIT chemically loosens soot deposits and scale from boiler heating surfaces and stacks. Thus XZIT simplifies cleaning problems . . . chipping and scraping are unnecessary . . . and tube blowers can do a really thorough job. XZIT actually increases boiler efficiency by facilitating heat transfer, reducing stack temperatures. This XZIT method of cleaning is applicable to any type of fuel which leaves a residue.



ASK FOR A DEMONSTRATION

in your own plant or write for trial sample.

XZIT FIRESCALE & SOOT ERADICATOR

1031 CLINTON STREET, HOBOKEN, N. J.
5800 S. HOOVER, LOS ANGELES, CALIF.

WICKES

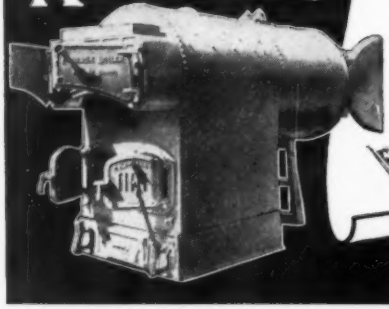
3-DRUM WATER TUBE BOILERS

Wickes 3-Drum Water Tube Boilers are especially designed for quick production of maximum steam at all ratings. Rapid steaming is assured by fast, unrestricted water circulation. Products of combustion travel through long, properly baffled passages which provide maximum scrubbing contact with water heating surface. Proper tube arrangement assures more effective absorption of radiated heat from the furnace. Entire installation readily accessible for inspection and maintenance. Write for complete information on how Wickes 3-Drum Water Tube Boilers will insure faster, more efficient power generation in your plant.

SALES OFFICES: Detroit, Mich.; Chicago, Ill.; New York City; Milwaukee, Wisc.; Pittsburgh, Pa.; San Jose, Calif.; Tulsa, Okla.; Fort Worth, Texas; Portland, Ore.; Saginaw, Mich.; Mexico City, Mexico, Boston, Mass.; Indianapolis, Ind.; Baltimore, Md.; San Francisco, Cal.

THE WICKES BOILER COMPANY, SAGINAW, MICHIGAN

Extra STRENGTH
for Heavy Duty
KEWANEE



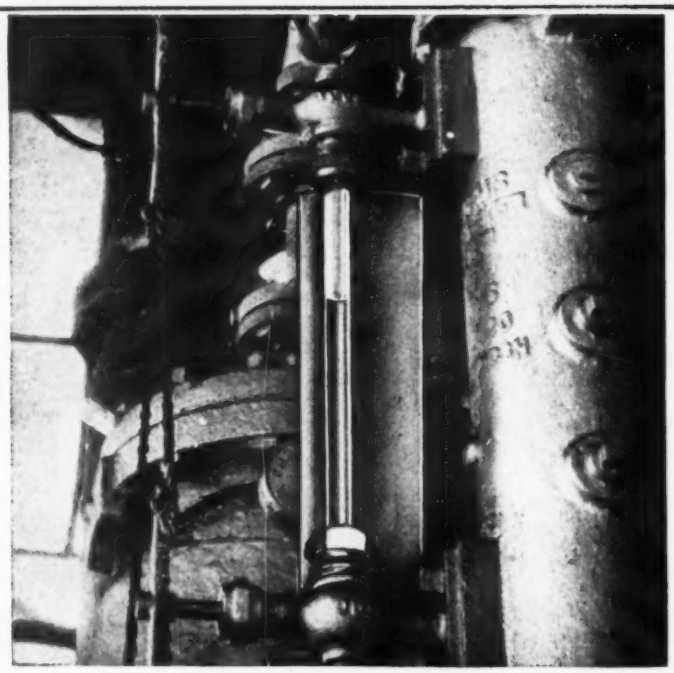
● Backed by more than 75 years of boiler building experience Kewanee Heavy Duty types have all the characteristics which make firebox boilers ideal for high pressure.

10 to 304 H.P.
100, 125, 150 lbs. W. P.

Built of steel with extra stout stays and braces to add further strength.

For 6" Scale with pipe diameter markings . . . WRITE Dept. 98-KB

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION



Gauge Glasses TESTED
by Years of Actual Use

Thousands of Pyrex and Corning Gauge Glasses installed years ago are still giving excellent service. Designed and recommended for specific service conditions these gauge glasses are the most economical you can buy.

They are made from glasses that are selected with full recognition of the pressures and conditions under which they are to be used. Machine drawn accuracy permits easy installation and reduces installation strain to a minimum. The smooth, hard surfaces resist abrasion and scratching. They resist the solvent action of hot water and steam. All of these factors mean long, economical, trouble-free performance. Corning Glass Works, Corning, N. Y.

"CORNING" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

CORNING
Glass Works
Corning, New York

Pyrex Gauge Glasses
BRAND

Gilbert Associates, Inc, has signed a contract with Chinese Supply Commission for design, erection and operation of seven electric-generating stations to be installed in Shanghai and other cities and towns in China, as a part of a long-range program for electrification of industry and homes in that country. These plants will be equipped by American manufacturers and assembled at a West Coast shipping point for installation in China as rapidly as possible.

National Bureau of Standards announces that a revision of "Simplified Practice Recommendation R100-29, Welded Chain," has been proposed by the Chain Institute, Inc. The standing committee in charge of the recommendation has approved the proposal for distribution to all interests for comment, acceptance or both. Copies of the proposed revision are available on request to *Div of Simplified Practice, National Bureau of Standards, Washington* 25, *D. C.*

Metallizing Co of America moved their Eastern office and warehouse to 431 E 75th St, New York 21, N. Y.

New York Belting & Packing Co, of Passaic, N. J., manufacturers of hose, belting and other industrial rubber products, is celebrating its 100th anniversary this year.

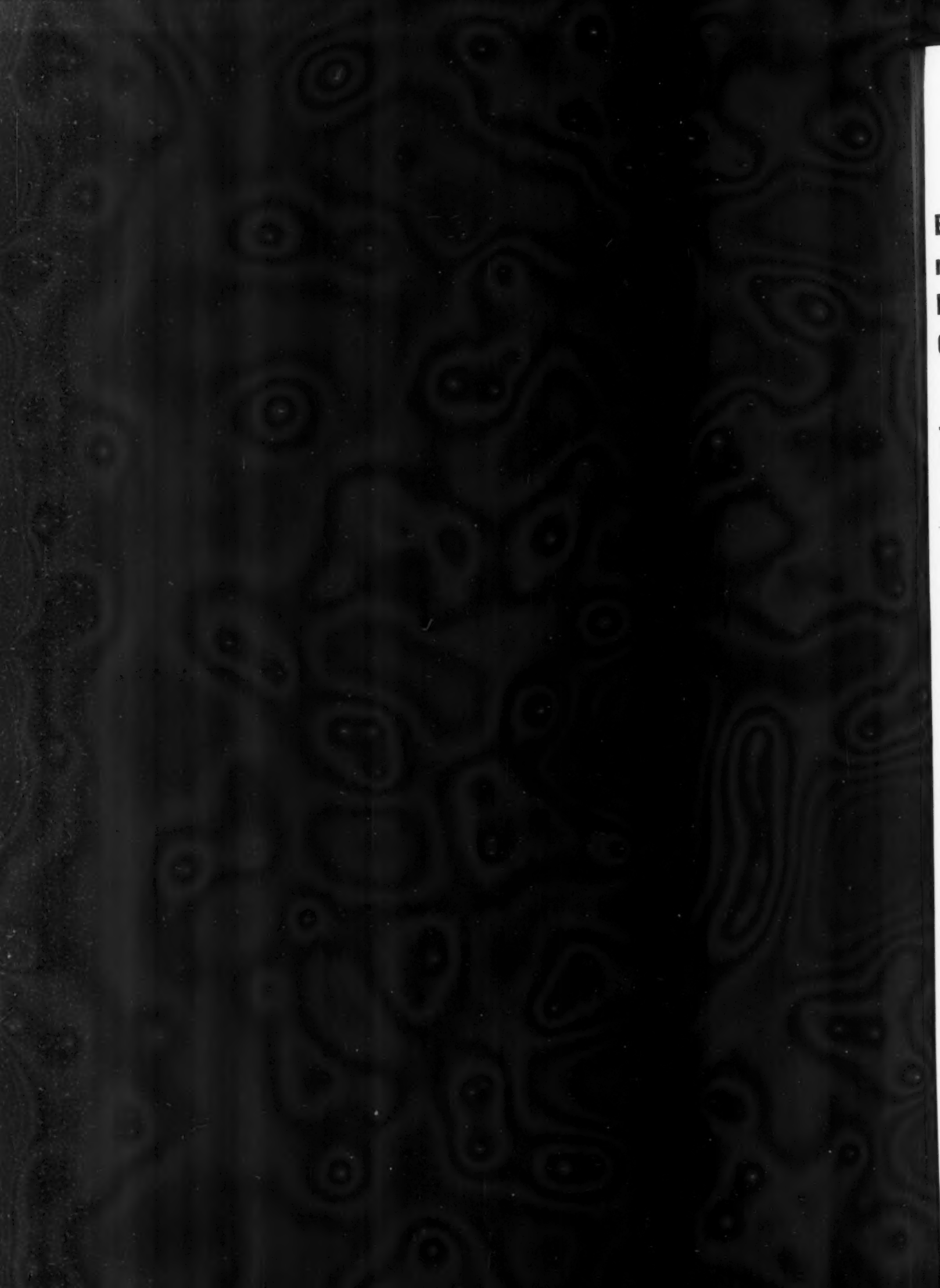
Lovejoy Flexible Coupling Co, 5001 W Lake St, Chicago 44, has acquired the manufacture and sales of mechanical-power-transmission dept of Ideal Industries, Sycamore, Ill.

Hagan Corp has acquired Plant No. 1 of the Willburt Co at Orrville, O., in which Hagan combustion-control equipment has been manufactured for 27 years. Hagan took possession July 1 and will begin an expansion program at the plant. The Willburt stoker operation is not affected by the purchase.

Brown Instrument Co, Philadelphia, has made outright purchase of the 5-story and basement structure at 2221 N Broad St in that city in preparation for physical expansion and business growth.

Walker L Cisler, chief engineer of power plants of Detroit Edison, left by plane for Paris, France, on June 24, to attend first postwar congress of *Cigre.* This is an international conference on high-voltage electric systems and equipment. Some 100 technical papers are being presented. Mr Cisler will also attend the meeting of the Public Utilities Panel of Emergency Economic Committee for Europe which he helped organize.

Board of Water and Power Commissioners approved a special 3-yr budget of $25,000,000 for installation of an additional 225,000-kw generating capacity in the city-owned utility's Harbor steam plant. Contracts were awarded for furnishing three new steam-turbine-generating units of 75,000-kw capacity each, with repair parts and supervisory instruments. Installation of the new generators is necessitated by rapidly increasing demands on Los Angeles municipal electric system.



NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library Up To Date With This Convenient Service

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

1 **RADIANT HEATING**—A M Byers Co, Pittsburgh, Pa. 52-page bulletin, entitled "Byers Wrought Iron for Radiant Heating," treats technical and mathematical aspects of radiant heating in the first section. Second part of bulletin deals with present-day methods and procedures of construction and installation.

2 **COLD-STORAGE INSULATION**—Dept CSM, Eagle-Picher Co, American Bldg, Cincinnati 1, O. First part of 28-page manual is devoted to characteristics of Eagle-Picher low-temperature insulations. Second section emphasizes importance of the vapor barrier. This section contains an explanation of application instructions and includes a number of installation sketches. Third part includes a chart showing temperatures and humidities for storage of foods and other products.

3 **AIR CONDITIONING, REFRIGERATING AND HEATING EQUIPMENT**—12-page catalog AIA No. 30-F-2 covers Carrier line of air conditioning, refrigerating and unit heating equipment. Catalog includes photos of different models. Applications of each model are given.

4 **REFRIGERATOR PLASTICS**—Chemical dept, plastics div, General Electric Co, Pittsfield, Mass. 4-page folder describes new plastics compound used in manufacture of sealing caps and sleeves. Designed primarily to protect tubes in condenser systems of refrigerators during the manufacturing process, the sealing caps and sleeves are said to be water resistant and have good electrical properties.

5 **RADIANT HEATING**—Chase Brass & Copper Co, Waterbury 91, Conn. 75-page booklet gives theory, broad principles and advantages of radiant heating and problems involved in its installation.

6 **HEATING AND VENTILATING EQUIPMENT**—L J Wing Mfg Co, 154 W 14th St, New York 11, N. Y. 6-page folder discusses Wing line of unit heaters, ventilating fans, turbines and blowers. Equipment photos are included.

7 **RADIANT HEATING**—Johnson Service Co, Milwaukee, Wis. 20-page booklet covers radiant heating systems, with particular reference to methods of control. It is intended as an engineering report on application of effective control to radiant heating installations.

BOILERS AND AUXILIARIES

8 **BOILERS AND RELATED EQUIPMENT**—Combustion Engrg Co, 200 Madison Ave, New York 16, N. Y. 12-page condensed catalog No. GC-10 summarizes each class of equipment and illustrations are included of typical units in each class group of boilers. Stokers, burners for pulverized coal, superheaters, economizers and air heaters are described.

9 **FEEDWATER REGULATOR**—Northern Equipment Co, Erie, Pa. 8-page bulletin No. 453, entitled "Controlling Boiler Feed Water for the New Generating Station at the New York Naval Shipyard," covers the subject thoroughly. This bulletin describes the Copes Flowmatic regulator for boiler feed control at the station.

HOW TO ORDER YOUR BULLETINS

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail.

Example

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg. Co.

Address 3718 First Avenue, Pottsville, Okla.

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

FILL OUT AND MAIL TODAY! NOT GOOD AFTER NOV. 1, 1946

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/46

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/46

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/46

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/46

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/46

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/46

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/46

Write in circle number of item describing one catalog wanted → ( )

Your Company Name .....

Address .....

.....

Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 8/

10 **BOILER CIRCULATORY SYSTEM**—John Phillips Badenhausen Inc, Packard Bldg, Philadelphia 2, Pa. 4-page bulletin No. 115 presents the Badenhausen circulatory system for increasing steam capacities in existing boilers. Diagrams show results attained with this system.

11 **FIRE TUBE BOILERS**—Brownell Co, 306 N Findlay St, Dayton 1, O. 4-page bulletin No. B-3 covers line of full-length and submerged fire tube boilers, ranging in capacity from 3 to 110 hp.

12 **STEAM GENERATOR**—Preferred Utilities Mfg Corp, 1860 Broadway, New York 23, N. Y. 6-page bulletin No. 1000-C describes the Preferred unit steam generator. This generator is a self-contained 4-pass oil-fired unit and is available in capacities from 20 to 500 hp and for pressures up to 200 psi.

13 **SCOTCH MARINE BOILERS**—Titusville Iron Works Co, Titusville, Pa. 4-page bulletin contains construction and installation details on the new Wee-Scot scotch marine boiler, with diagrams and illustrations. This boiler is made in working pressures of 100, 125 and 150 psi.

14 **STEAM-GENERATING UNIT**—Orr and Sembower, Inc, Reading, Pa. Bulletin outlines features of the Powermaster unit, which is said to be designed for full steam pressure in as little as 18 min. It is a packaged power plant.

CONTROLS, MECHANICAL

15 **TEMPERATURE CONTROL**—Precision Thermometer & Instrument Co, 1401 Brandywine St, Philadelphia 30, Pa. 12-page bulletin No. "T" discusses Princo thermoregulators, thermostats and relays. Photographs of equipment are included.

16 **PYROMETER SUPPLIES**—Accessories and supplies div, Brown Instrument Co, Philadelphia 44, Pa. 40-page booklet is a buyers' guide on standard pyrometer supplies. Booklet presents information on how to order thermocouples, protecting tubes, thermocouple wire, lead wire, insulators, etc. Booklet contains descriptions and prices on various standard thermocouples.

17 **TEMPERATURE CONTROL**—Wheelco Instrument Co, 847 W Harrison St, Chicago 7, Ill. 4-page bulletin No. D4-2 describes the company's newest development in electronic temperature control, the Multronic Capacitrol. Bulletin lists applications and features of the new instrument, describes operation and shows typical installation diagrams.

18 **FLOW-RATE MEASURING INSTRUMENT**—Dept 6G-4, Fischer & Porter Co, Hatboro, Pa. 4-page catalog No. 52-A discusses Rota-Tronic remote instruments for use with Rotameters to indicate, record, totalize and control miniature flow rates down to 5 milliliters per min.

ELECTRICAL EQUIPMENT

19 **SYNCHRONOUS MOTORS**—Electric Machinery Mfg Co, Mineapolis, Minn. 24-page booklet No. 1068, entitled "Selection and Application of Synchronous Motors and Synchronous Motor Control," gives special attention to operating characteristics, including power factor, torques and flywheel effect.

20 **REVERSING STARTERS**—General Electric Co, Schenectady, N. Y. 4-page bulletin No. GEA-4368 covers ac magnetic reversing starters for full-voltage starting of squirrel-cage induction motors. Construction features are illustrated by photos.

21 **FLUORESCENT LAMPS**—Advertising and sales promotion dept, lamp div, Westinghouse Electric Corp, Bloomfield, N. J. 24-page booklet No. A-4759 gives principles and operating characteristics of fluorescent lamps and auxiliaries.

22 **RENEWABLE FUSES**—Pierce Renewable Fuses, Inc, 117 Pacific Ave, Buffalo 7, N. Y. Folder presents Pierce Balanced-Lag fuses. Features of construction are outlined. Prices are given for various models.

23 **AC GENERATOR**—Electric Machinery Mfg Co, Minneapolis 13, Minn. 4-page publication No. 186 presents the newly developed Regulectric ac generator for engine generator sets. Regulectric provides general-purpose electric power at constant voltage, using a built-in voltage regulating circuit employing principle of series resonance.

24 **CAPACITOR MOTORS**—General Electric Co, Schenectady, N. Y. 8-page bulletin No. GEA-4443 describes GE capacitor motors for jet-pump drive. Bulletin gives application, construction, operation and service of these capacitor motors. Dimensions are included.

25 **ELECTRIC COUNTER**—Royal Electric Mfg Co, 1122 E 87th St, Chicago 19, Ill. 4-page bulletin covers application data on MA electric counters. Counters are for panel mounting and record operations of circuit breakers, switches, elevators, pumps, scales and production machines where a count is desired.

26 **PRESSURE CONNECTORS**—Thomas & Betts Co, Elizabeth 1, N. J. 34-page bulletin No. 64 contains complete information on line of Lock-Tite pressure connectors. It includes installation photographs depicting various applications of several items in the line, as well as brief resumes of pressure connectors in allied lines.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **SYNTHETICS**—Celanese Corp of America, 180 Madison Ave, New York 16, N. Y. 20-page booklet, entitled "Celanese Synthetics for the Electrical Industry," outlines the various Celanese synthetics, their characteristics, mechanical and electrical properties, and some of their applications in the electrical field.

MAINTENANCE AND SAFETY EQUIPMENT

27 **ELECTRIC TOOLS**—Syntron Co, Homer City, Pa. 40-page catalog No. 464 describes complete line of Syntron electric tool equipment, which includes portable electric hammers, drills, screwdrivers, nut runners, grinders, sanders and semi-portable hack saws.

28 **FIRE HOSE NOZZLE**—Grinnell Co, 260 W Exchange St, Providence 1, R. I. 12-page booklet presents the Mulsifyre, a fixed system of high-velocity spray for extinguishing oil and flammable liquid fires; ProtectoSpray, a fixed system of medium-velocity spray for protecting tanks, structures and equipment by cooling; and Flame-Buster, a 3-purpose hose nozzle for solid stream or high- or low-velocity spray application.

(*Continued on page 188*)

FIRST CLASS
PERMIT No. 64
(Sec.510,P.L.&R.)
NEWYORK,N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

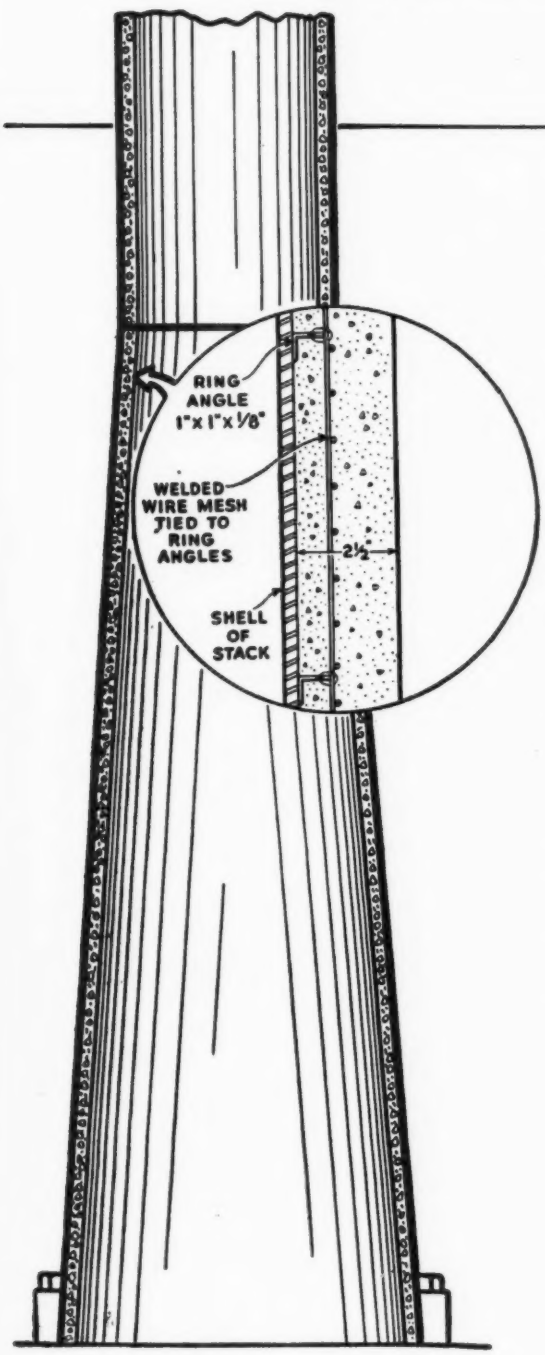
4c Postage Will Be Paid By—
POWER
330 West 42nd Street
New York 18, N. Y.

FIRST CLASS
PERMIT No. 64
(Sec.510,P.L.&R.)
NEWYORK,N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c Postage Will Be Paid By—
POWER
330 West 42nd Street
New York 18, N. Y.

PROTECT STEEL and IMPROVE DRAFT with LUMNITE STACK LININGS



Corrosion-resistant linings insure long life for steel stacks. Insulation prevents oxidation, keeps gas temperature up and boosts the draft. LUMNITE linings are refractory, insulating and resistant to corrosion.

Stop oxidation, prevent the corrosive action of sulphurous flue gases, insulate the steel from high temperatures, and you have forestalled the enemies that destroy steel stacks. The jointless LUMNITE linings are in close contact with the steel. They allow no "breathing"; aggressive condensate cannot reach the shell of the stack.

A LUMNITE lining only 2½ inches to 3 inches thick gives full protection, while it allows maximum effective draft area. The efficiency of an old stack is increased; a new stack may be designed for greatest economy of steel.

In new stacks or old, it's easy to install these LUMNITE linings. Reinforcing mesh is attached to steel angles or other projections welded to the steel shell . . . the mixture of LUMNITE and insulating, corrosion-resistant aggregate is applied over the reinforcing mesh . . . then, 24 hours later, the lining is ready for service.

7 Ways to Use LUMNITE in Power Plants

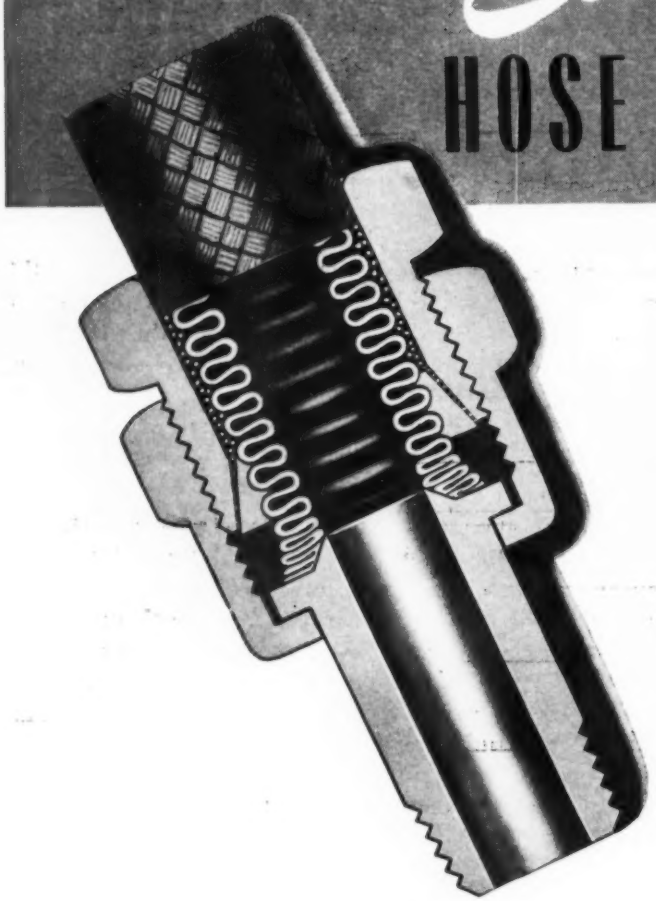
1. Ash Pit and Cinder Catcher Linings.
2. Coal Bunker Linings.
3. Flue and Duct Linings
4. Steel Stack Linings.
5. Mortar for Brick Chimneys and Linings.
6. Castable Refractories.
7. Overnight Structural Concrete

For information on stack linings and other uses of LUMNITE in the power plant, write:

LUMNITE DIVISION*
Universal Atlas Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Building **New York 17, New York**

**Formerly The Atlas Lumnite Cement Company*

WHY THIS COUPLING GIVES YOU *Extra* HOSE LIFE



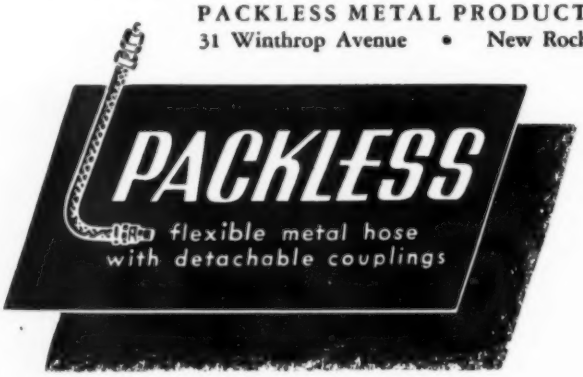
It is easy to see *why* the *coupling* on **PACKLESS** flexible metal hose adds to the life of the hose itself...

First, there is no soldering or brazing heat to weaken the structure of metal hose at the coupling, where flexing strain is greatest.

Second, its built-in union makes it easy for your regular maintenance man to install the hose without "twist" which would strain the hose under repeated flexing.

So...while you are replacing leaky flexible metal hose, bear in mind the importance of the *type of fittings* you use.

PACKLESS METAL PRODUCTS CORP.
31 Winthrop Avenue • New Rochelle, N. Y.



A-2330

New Bulletins

(*Continued from page* 186-b)

29 **SEAT GRINDER**—Lagonda div, Elliott Co, Springfield, O. 4-page bulletin Y-22 discusses Elliott handhole seat grinder, now available in air-driven and electric-driven models. This machine grinds handhole seats in boilers and superheaters.

30 **DEFECTIVE TUBE DETECTOR**—Shell Development Co, 50 W 50th St, New York, N. Y. 8-page booklet introduces the electronic Probolog. This detector, equipped with a flexible cable terminating in a magnetic probe, locates eroded spots, corroded pits, dezincification areas, cracks and abnormal changes in physical dimension of nonmagnetic tubes in steam condensers and heat exchangers.

31 **GAS MASKS**—Mine Safety Appliances Co, Braddock, Thomas & Meade St, Pittsburgh, Pa. 4-page bulletin describes industrial gas masks for protection against industrial gases or combinations of gases, smokes, vapors, and dusts (with exception of carbon monoxide and illuminating gas).

32 **PIPE TOOLS**—Beaver Pipe Tools, Warren, O. 4-page condensed catalog covers Beaver line of pipe tools, which includes pipe cutters, threaders, ratchet handles, etc. Photos of equipment are given.

33 **SOLDERING IRON**—Hexacon Electric Co, Roselle Park, N. J. Page introduces the Hexacon P-150 soldering iron. This soldering iron weighs 1⅛ lb and has a ⅝ in. tip dia.

MAINTENANCE MATERIALS

34 **MECHANICAL PACKINGS**—Asbestos textile and packing div, Raybestos-Manhattan, Inc, Manheim, Pa. 64-page catalog contains a short history of the Raybestos-Manhattan organization. A description with illustration is included of various styles and types of mechanical packings in the expanded R/M line, together with charts showing kind of service for each style packing.

35 **CHEMICAL COATINGS**—Perolin Co, 10 E 40th St, New York 16, N. Y. 16-page booklet covers chemical treatments or coatings for boilers, condensers, water systems, oil burners, cooling and refrigerating installations, in-bottle pasteurizers, storage tanks and other industrial apparatus.

36 **HYDRAULIC PACKING** — James Walker Packing Co, 96 Liberty St, New York, N. Y. 4-page booklet describes Walker's Lion automatic hydraulic packing for high pressures. Photos of packing are included.

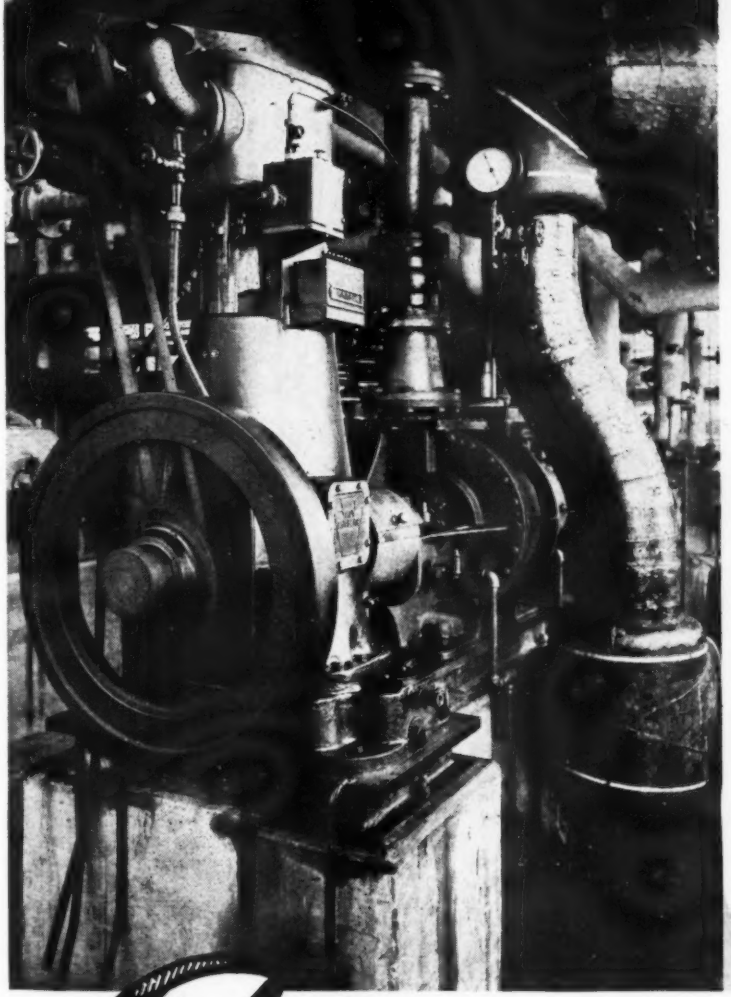
37 **PROTECTIVE COATINGS**—Dept T13, Dampney Co of America, Hyde Park, Boston 36, Mass. 4-page bulletin presents Thur-Ma-Lox high-heat resistant coatings for protection of metal surfaces against temperature damage in power and process equipment. Bulletin describes what they do and how they are applied, with a list of typical applications.

38 **FUEL-OIL TREATMENT** — Perolin Co of New York, 10 E 40th St, New York 16, N. Y. 6-page folder gives directions for using Perolin fuel-oil treatment. Advantages are listed.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **STEAM-CLEANING MATERIAL**—Oakite Products, Inc, 23 Thames St, New York 6, N. Y. 2-page service report discusses Oakite Composition No. 92. This heavy-duty alkaline detergent cleans machinery and equipment parts for subsequent repair and overhaul, prepares equipment surfaces for repainting or refinishing, cleans equipment too large for tank immersion or where suitable tanks are not available, strips paint, etc.

By-Product POWER drives this BLOWER



TROY—ENGBERG STEAM ENGINE

. . . AND BEING TROY ENGINE POWER IT IS EXCEPTIONALLY LOW COST POWER

Perhaps you aren't familiar with what we call "By-Product" Power. It's power that is extracted from steam drawn from the boiler plant for use in processing or in a heating system.

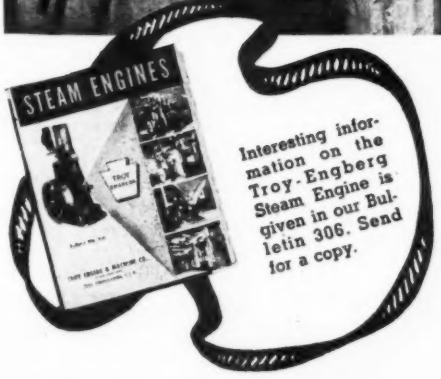
The Troy-Engberg Steam Engine is industry's unit for this purpose. It is ideal for driving pumps, compressors, blowers, fans, generators, cookers and other equipment that calls for conservative speed. It passes on in the exhaust approximately 90% of the heat units originally in the live steam. Case studies show that this power after a few months or a year or two costs practically nothing.

We suggest you look fully into the advantages to be gained by driving your equipment with Troy Engines.

TROY ENGINE & MACHINE COMPANY

Established 1870

2518 Railroad Avenue • Troy, Pennsylvania



Interesting information on the Troy-Engberg Steam Engine is given in our Bulletin 306. Send for a copy.

TROY-ENGBERG

STEAM ENGINES • GENERATING SETS • GENERATORS

Is It Difficult to Find Good Firemen?

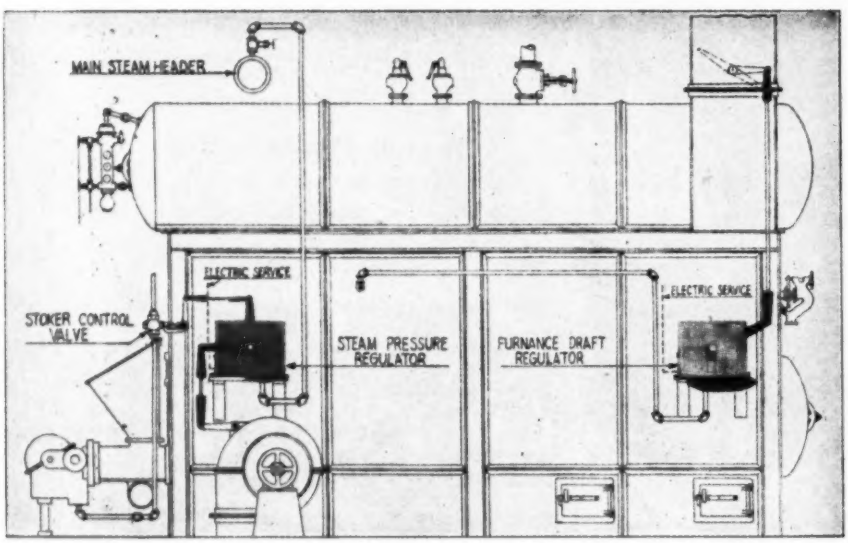
•

If So, You Will Want This

COMBUSTION CONTROL

•

BROOKE REGULATORS HAVE BEEN APPLIED AS SHOWN FOR 20 YEARS



Application of steam pressure regulator to control forced draft air and stoker speed. Furnace draft regulator applied to uptake air damper.

Advantages of this arrangement:

1. **Simplicity.**
2. **Hand Control from switch on regulator.**
3. **All Brooke Regulators are electrically actuated, and do not require any water or compressed air for operation.**
4. **No pilot valves, stuffing boxes or strainers are used.**
5. **Rigid link connections used throughout. No pulleys—no chain—no cables!**

Brooke's Steam Pressure Regulator type JSC controls forced draft air either by means of damper or by changing fan speed. It also controls stoker speed (or fuel oil) to furnace by means of fuel control valve. Furnace draft regulator type JFC operates boiler outlet damper to maintain furnace draft within .01" H_2O.

For further details write without delay for illustrated booklet.

BROOKE ENGINEERING CO., INC.

1517 Wayne Avenue • Philadelphia, Pa.

MANUFACTURERS OF THE FIRST SUCCESSFUL ELECTRIC EYE SYSTEM OF COMBUSTION CONTROL

MATERIALS HANDLING

39 CRANE DISCONNECT SWITCHES—Electric Controller & Mfg Co, 2700 E 79th St, Cleveland 4, O. Bulletin No. 1024 describes magnetic safety disconnect switches for dc cranes. Four sizes are now available, for which the bulletin gives complete information as to ratings, dimensions, etc.

40 BELT CONVEYOR IDLERS—Chain Belt Co, 1600 W Bruce St, Milwaukee 4, Wis. 26-page bulletin No. 463 is on the complete line of Rex belt conveyor idlers. Photos, tables, charts, diagrams and cutaway views illustrate and describe the items.

41 CRANE COST RECORD—Whiting Corp, Harvey, Ill. 4-page form, entitled "Crane Maintenance Cost Record," provides space to enter figures from maintenance work orders or time and material tickets. Such records quickly show which cranes are paying their way and which are scheduled for replacement.

42 MAGNETIC CRANE CONTROL—Electric Controller & Mfg Co, 2700 E 79th St, Cleveland 4, O. 8-page bulletin No. 931 introduces new line of controllers for operating ac cranes from floor level.

MECHANICAL TRANSMISSION

43 V-BELT DRIVE—Multiple V-Belt Drive Association, 22 W Monroe St. Chicago 3, Ill. 16-page booklet, entitled "How the Dominant Drive Speeds Production, Reduces Costs," does not go into engineering details. Instead, it presents results of engineering features of multiple V-belt drive in terms of operating advantages to drive users.

44 FLEXIBLE COUPLINGS—American Flexible Coupling Co, Erie, Pa. 32-page catalog No. 461 describes American and Amerigear flexible couplings. Catalog gives installation, operation, application and selection of these couplings.

45 BELTS—Hewitt-Robins Inc, Buffalo, N. Y. Catalog includes specifications on company's wide line of conveyor, transmission and elevator belting sold under brand names of Monarch, Ajax and Conservo. Maintenance suggestions advise users how to prolong life of belts and avoid production delays.

46 FLEXIBLE COUPLINGS—Crocker-Wheeler div, Joshua Hendy Iron Works, Ampere, N. J. 4-page bulletin No. SL-1000-1 stresses simplicity of design and long life of Crocker-Wheeler couplings. Photographs reveal coupling in operation and a cutaway view shows features of construction.

METERS AND INSTRUMENTS, MECHANICAL

47 FLOW-RATE METER—Dept 6G, Fischer & Porter Co, Hatboro, Pa. 4-page catalog section No. 31-E presents small-sized Rotameter for purge-line service. It may be furnished with or without an integral needle valve.

48 INSTRUMENTS AND GAGES—Instrument and gauge div, Electric Auto-Lite Co, Chrysler Bldg, New York, N. Y. 40-page catalog describes pressure gages, vacuum gages, retard gages, compound gages, compound retard gages, back-connected pressure gages, combination altitude pressure and thermometer gages, indicating and recording thermometers, etc.

49 SURFACE PYROMETER—Pyrometer Instrument Co, 103 Lafayette St. New York 13, N. Y. Catalog No. 160 presents the new Pyro surface pyrometer. Constructed in a shock, moisture and dust-proofed shielded steel housing, pyrometer is immune to external magnetic influences.

PIPING, FITTINGS, VALVES AND SPECIALTIES

50 WATER - COLUMN TRY - COCKS—Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa. 4-page bulletin No. WG-1815 introduces Sealtite Try-Cocks. Dimensions, prices and parts are given.

DISSOLVED OR ENTRAINED AIR

in circulating water—one of many factors governing condenser tube and heat exchanger tube performance—is presented in this discussion by Scovill engineers on selection of the proper tube alloy.

Fast-flowing rivers, rapidly changing tides, spray ponds and moving ships all create a condition causing entrainment of air. Furthermore, all raw water is saturated with dissolved air. Approximately 27 cu. ft. of air will dissolve in 1000 gal. of water — the quantity of air to saturate being dependent on the water pressure, composition and temperature. Any low-pressure areas in the circulating system permit the liberation of part of this dissolved air to ally itself with any free air in its erosive-corrosive attack on the tubes.

In actual operating conditions, where dissolved or entrained air in the circulating water is only one of the variables, tube life depends on the nature and/or extent of such other factors as: Velocity and turbulence of coolant . . . Chemical composition of circulating water . . . Temperatures inside and outside of tubes . . . Chemical or electro-chemical actions . . . Marine growths or other deposits . . . Sewage and wastes present . . . Development of protective film . . . Media surrounding tubes.

One of the principal objects of Condenser Tube Technical Research has been the development of alloys designed to give the user longest tube life and most trouble-free service. Where the major factor affecting tube life is the presence of dissolved or entrained air, satisfactory alloys include Cupro-Nickel, Aluminum Brass and Phosphorized Admiralty, each within its temperature limitations.

So many variables surround any condenser or heat exchanger tube application that each case must be treated as an individual problem.

Data accumulated during Scovill's continuous study of condenser and heat exchanger tube service conditions for every known application equip its Technical Service Department to offer sound guidance in tube alloy selection for existing or proposed installations.

THREE SCOVILL SERVICES

Scovill's *Service in Men* offers experienced engineering to help solve your tube selection and installation problems. *Service in Metals* develops and produces Scovill tube alloys that conform to your requirements. *Service in Manuals* consists of literature which gives you latest, authentic information on condenser and heat exchanger tubes. For a free copy of Condenser Tube Booklet, address Scovill Manufacturing Co., 13 Mill St., Waterbury 91, Conn. *Export Dept.* 405 Lexington Ave., New York 17, N. Y.

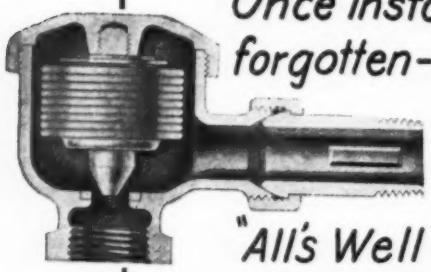
SCOVILL

SCOVILL

CONDENSER TUBES

One Product • Three Services

Service in Manuals . Service in Metals . Service in Men



Once installed they can be forgotten- so just remember the name ....

CRYER!

"All's Well with CRYER TRAPS"

CRYER THERMOSTATIC RADIATOR TRAPS

Quiet, efficient and simple, CRYER RADIATOR TRAPS operate noiselessly and economically on any two-pipe low pressure steam, vapor or vacuum heating system. They allow water, air and gases to pass from the radiator into the return line, while preventing steam from doing so.

The contents of the radiator flowing into the trap surround a metallic bellows containing a volatile liquid. If only condensed water and gases are in the trap, at a temperature less than that of steam, the volatile liquid in the bellows and the bellows itself expand slightly, but not enough to close the opening between the plug on the end of the bellows and the seat through which the contents flow into the return line.

As soon as steam enters the trap, its higher temperature causes expansion of the bellows sufficient to close the opening between the plug on bellows and the seat, thereby preventing steam from flowing into the return line. When steam again is absent from the trap, the bellows contracts and the seat is again uncovered.

Made in ½" and ¾" sizes; max. pres. 30 lbs.; rated for 300 and 400 ft. radiation. Conform to Heating and Piping Contractor's National Association Specifications.

We are also prepared to furnish repair parts for the line known as the J-M Ball Steam Trap.

ALSO:

Inverted Bucket Steam Traps in capacities from 500 to 38,000 lbs. of steam for pressures up to 250 lbs.

CRYER TRAP AND VALVE CO., INC.

366 MADISON AVE. NEW YORK 17, N. Y.

Manufacturers of steam specialties for more than forty years

Install safe, economical

MACWHYTE ELEVATOR ROPES

Order through your Distributor or Elevator Maintenance Man

6 x 19 Macwhyte Traction Steel, PREformed or Non-PREformed

If you want elevator ropes with a minimum of stretch, yet ample flexibility to withstand bending fatigue, specify Macwhyte. Made of tough, long-life wire drawn from selected steels in our own mill. Strict metallurgical control gives uniform high quality and long service.

Your Elevator Maintenance Man can get low-cost-per-car-mile Macwhyte Elevator Ropes from Macwhyte Distributors and Mill Depots.

PREformed and Non-PREformed elevator ropes

8 x 19 Macwhyte Special Traction Steel, PREformed or Non-PREformed

MACWHYTE COMPANY

2944 Fourteenth Avenue, Kenosha, Wisconsin

Makers of the correct ropes for your equipment

MACWHYTE COMPANY 50th Year 1896 - 1946

NO. 871-E

51 STRAINERS AND SEPARATORS—American District Steam Co, N Tonawanda, N. Y. 16-page bulletin No. 46-50 describes line of ADSCO strainers and separators. Bulletin gives dimensions and list prices on Y strainers, T strainers, large pipeline Macomb strainers for water or oil service, horizontal and vertical separators for steam, air or gas service, as well as receiver separators for various installation conditions.

52 CARTRIDGE DESUPERHEATER—Accessories dept, Elliott Co, Jeannette, Pa. 4-page bulletin No. U-1 tells how the Elliott cartridge desuperheater operates. Sizes and dimensions are included.

53 SAFETY AND RELIEF VALVES—Farris Engrg Co, 400 Commercial Ave, Palisades Park, N. J. Bulletin No. 40 gives essential construction and operation specifications for twenty basic designs of improved safety and relief valves.

54 STEAM-JET AIR EJECTORS—Condenser Service & Engrg Co, Hoboken, N. J. 8-page catalog shows various applications of Conseco steam-jet air ejectors for power plant, industrial and marine use. Catalog contains engineering data, specifications, graphs and tables to help the engineer to select suitable equipment.

55 VALVES AND OTHER EQUIPMENT—Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa. 12-page bulletin No. G-1206 describes Yarway blowoff valves, water columns and gages, expansion joints, steam traps and strainers, spray nozzles and liquid-level indicators. Equipment photographs are included.

56 TUBING HEAD—National Supply Co, P O Box 899A, Toledo 1, O. 6-page bulletin No. 327 features six detailed cutaway drawings of applications of Type W tubing head. Type W is a flexible unit designed to support a string of tubing and to seal that string from the casing.

57 STEAM TRAP—V D Anderson Co, 1935 W 96th St, Cleveland, O. 40-page booklet, entitled "How to Choose a Steam Trap," contains a considerable amount of engineering information on application of steam traps. This includes charts for sizing traps, as well as tables showing proper sizes of Super Silvertop traps for various equipment.

58 VALVES—Orbit Valve Co, Tulsa 1, Okla. 18-page catalog No. 45 gives specifications, prices and sizes of Orbit valves. Sheet No. 2 gives new prices of steel valves shown in catalog No. 45. Single sheet describes Orbit forged-steel valve. Single sheet consists of a parts list for Nolos stuffing boxes.

59 STEAM TRAPS—V D Anderson Co, 1935 W 96th St, Cleveland 2, O. 4-page folder, entitled "Let's Raise The Blind on Steam Traps," describes different kinds of steam traps. Included are float traps, thermostatic traps, combination float and thermostatic traps, orifice traps and inverted bucket traps.

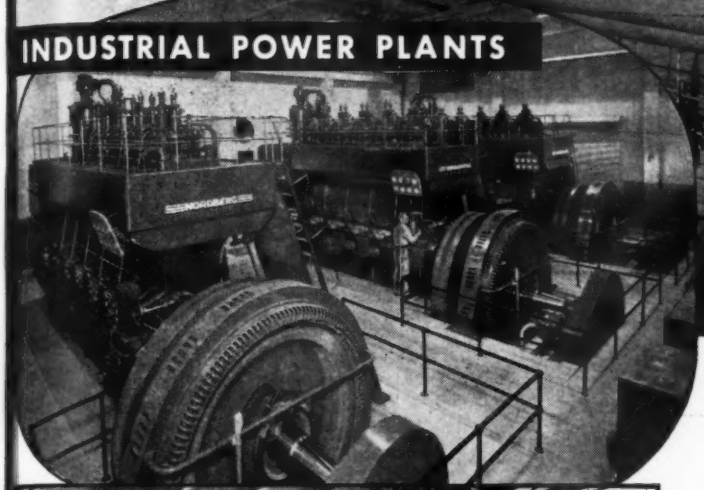
PRIME MOVERS AND ACCESSORIES

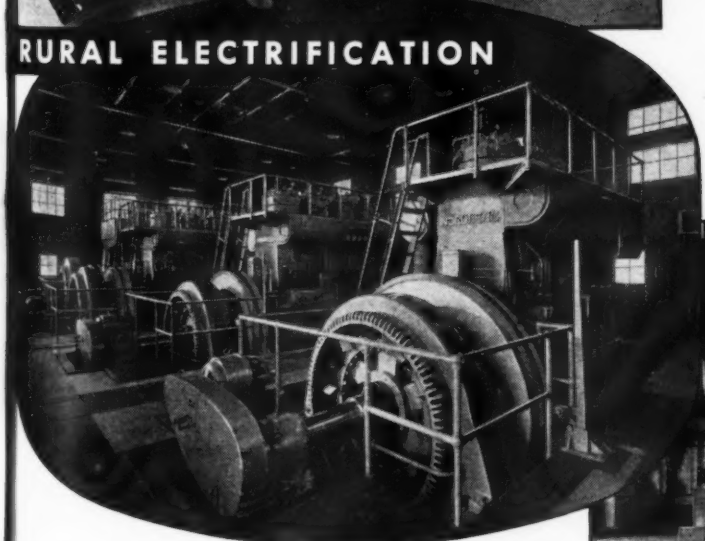
60 DIESEL ENGINE—Detroit diesel engine div, General Motors Corp, 13400 W Outer Dr, Detroit 23, Mich. 12-page booklet, entitled "35,000,000 Is A World of Horsepower," goes back to origin of diesel engine and sketches General Motors' part in development of the high-speed 2-cycle engine.

61 CONDENSER INJECTOR—Condenser Service & Engrg Co, Hoboken, N. J. 4-page bulletin presents the Wizard condenser injector which is said to instantly stop tube leaks while condenser continues to operate.

62 DIESEL ENGINES—Nordberg Mfg. Co, Milwaukee 7, Wis. 40-page bulletin No. 126 on diesel engines shows application in stationary engine field. Photographs and tables are included.

63 DIESEL ENGINE SCAVENGER—Roots-Connersville Blower Corp, Connersville, Ind. 24-page bulletin No. 22-23-B-12 covers rotary positive blowers for supercharging and scavenging of diesel engines, activated sewage disposal plants, pneumatic conveying service, coal treatment, etc.





DIESEL POWER *meets* TODAY'S DEMANDS

Low cost power supplied from a dependable source is of prime importance to every power user. Innumerable installations of economical, reliable Nordbergs prove conclusively that these demands are met with Diesel power. Nordbergs are built in two and four-cycle types in a range of sizes to 8500 horsepower in a single unit. When in need of additional power or a more economical unit, investigate the advantages of Nordberg Diesel power.

NORDBERG MFG. CO., MILWAUKEE 7, WIS.

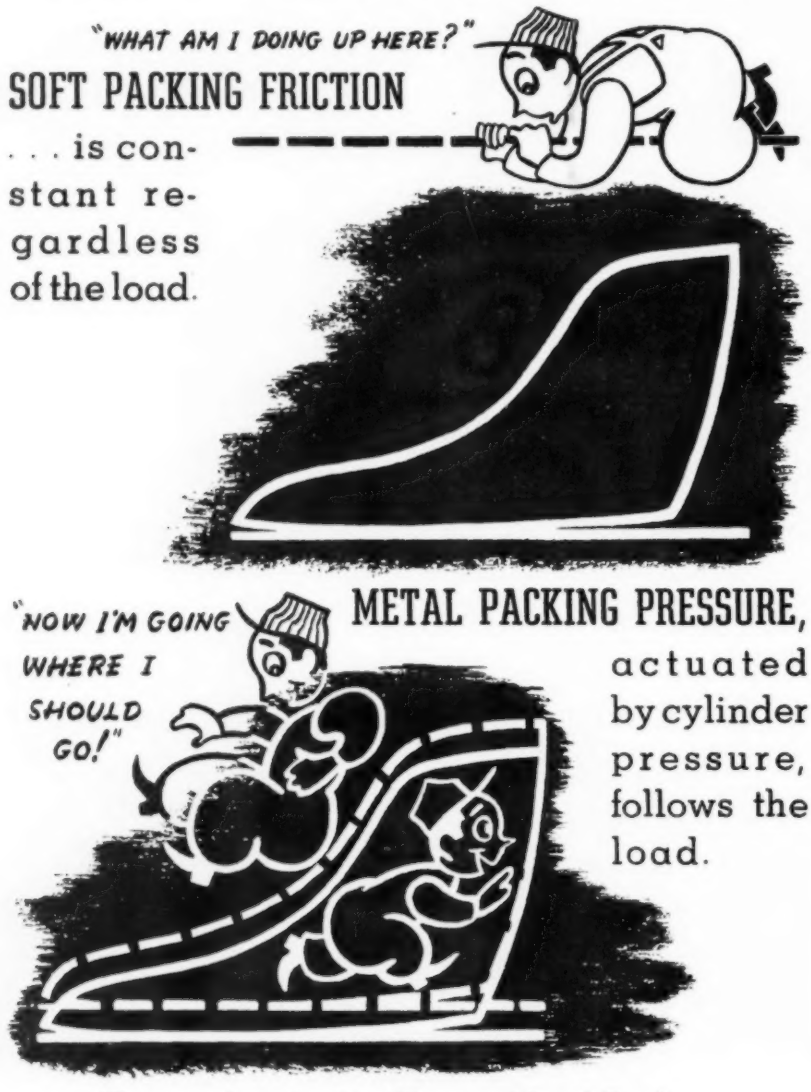
NORDBERG MACHINERY

NORDBERG

DIESEL ENGINES

NORDBERG MACHINERY

VARIABLE RING PRESSURE IS THE *Secret* that eliminates the Eternal Drag of soft packing friction


"WHAT AM I DOING UP HERE?"
SOFT PACKING FRICTION
. . . is constant regardless of the load.
"NOW I'M GOING WHERE I SHOULD GO!"
METAL PACKING PRESSURE, actuated by cylinder pressure, follows the load.

The results of using France Metal Packing are minimum power consumption, negligible rod wear and long life with outstanding economy.

FRANCE PACKING COMPANY
PHILADELPHIA 35, PA.

REPRESENTATIVES IN PRINCIPAL CITIES

64 DIESEL ENGINES—Cooper-Bessemer Corp, Mt. Vernon, O. 4-page bulletins No. L-31, L-32 and L-51 discuss stationary Type LS engine as an unsupercharged and supercharged diesel and as a gas diesel. Bulletins include photos, cross-sections, diagrams and charts.

PUMPS

65 ROTARY PUMPS—Quimby Pump Co, 342 Thomas St, Newark, N. J. Bulletin discusses Streamflow Rotex pumps, which are rotary positive-displacement pumps for moderate- or low-viscosity liquids under medium pressure. Folder contains complete specifications, dimensions and performance charts.

66 AXIAL-FLOW PUMPS—S Morgan Smith Co, York, Pa. 28-page bulletin No. 148 gives performance characteristics and construction details of Smith axial-flow pumps. Photos, diagrams, charts and cross-sections are included.

67 ROTARY PUMPS—Geo D Roper Corp, Rockford, Ill. 4-page bulletin No. 10 covers ¾-, 1½- and 3-gpm Series K rotary pumps. They are adapted to diesel fuel-oil transfer work, pressure-lubricating jobs, hydraulic service, fuel-supply duty, industrial and large domestic oil burners, etc.

68 PISTON PUMPS—Warren Steam Pump Co, Warren, Mass. 4-page bulletin No. 230 gives complete information on Realwear horizontal duplex-piston pumps, including detailed description of special mechanical features, metal specifications, sizes, capacities and dimensions.

69 CENTRIFUGAL PUMPS — Carver Pump Co, Muscatine, Iowa. 8-page bulletin No. 200 describes new line of centrifugal pumps, known as Electropumps. These pumps range in capacity from 40 to 900 gpm and heads up to 200 ft or higher.

WATER TREATMENT

70 CHEMICAL PROPORTIONING EQUIPMENT—Proportioneers, Inc, 9 Codding St, Providence 1, R. I. 4-page bulletin No. 1714 presents packaged units for constant-rate chemical feeding. Equipment photos are shown.

71 WATER-LEVEL CONTROL—Northern Equipment Co, Erie, Pa. 8-page bulletin No. 451, entitled "Water Level Control at Parkchester," covers the subject thoroughly. Bulletin discusses how water level is controlled on boilers which heat this housing project.

72 TITRATION INDICATOR—Fleisher Chemical Co, Benjamin Franklin Station, Washington 4, D. C. 8-page folder introduces Fleisher methyl-purple indicator as a standard for total alkalinity titrations.

73 WATER CONDITIONING—W H & L D Betz, Gillingham & Worth St, Philadelphia 24, Pa. 16-page booklet, entitled "The Six Fundamentals of Betz Water Conditioning Service," describes how W H & L D Betz extends a supervisory service for boiler water conditioning.

WELDING

74 ARC WELDER—Hobart Brothers Co, Box DM-706, Troy, O. 4-page booklet presents the new Hobart 200, a 200-amp gas-engine drive arc welder. Folder DM-652 provides a check list of welder's needs.

75 ELECTRODE CHART—Ampco Metal, Inc., 1745 S 38th St, Milwaukee 4, Wis. Sheet, entitled "Comparative Bronze Electrode Chart," contains AWS-ASTM classification of bronze electrodes and the grade numbers of arc-welding rods produced by 15 manufacturers which meet various classifications.

76 LIME-FERRITIC ELECTRODE—Metal & Thermit Corp, 120 Broadway, New York 5, N. Y. 16-page bulletin describes a new electrode, known as Type HTS, designed to prevent underbead cracking in welding of "difficult-to-weld" steels.

77 BRONZE ELECTRODE—Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. 8-page bulletin No. W-9 discusses in detail five grades of Ampco-Trode ac electrodes. It is illustrated with photographs, contains a table of physical properties, lists 57 applications and gives outstanding features of the new weld rod.

BETTER COAL PREPARATION with AMERICANS means MORE EFFICIENT FIRING

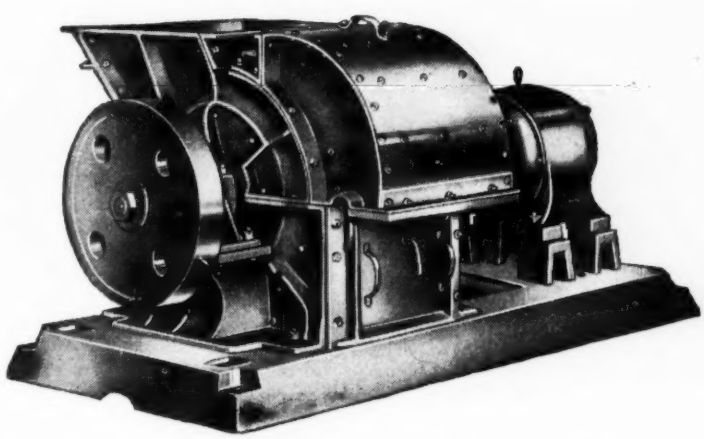
Ragged firing from alternately excess air and insufficient air . . . excessive CO_2 instead of uniform combustion . . . loss from ash pit drops—are costly combustion inefficiencies not common to uniformly sized coal. Even poorer grades, when they are the only coal available, have improved combustion efficiency when uniformly sized.

The uniformly crushed product of American Rolling Ring Crushers assure efficient combustion. ROM or lump coal is rapidly reduced to stoker or pulverizer size with controlled minimum or maximum fines and no oversize.

American's uniform, crushed product and high tonnage results from its efficient, rapid-impact splitting action . . . 20 cutting edges on each of its free-swinging shredder rings mounted in multiples on their own shafts on the heavy-duty rotor.

PATENTED MANGANESE STEEL SHREDDER RINGS

Shredder rings are of manganese steel and each ring is equipped with 20 cutting edges that split—instead of crush coal—to uniform size. They deflect from tramp metal, eliminating shear pins and other conventional safety devices.



Housing of massive, high-test cast sections. Rib-reinforced to withstand enormous crushing strains. Anti-friction type bearings . . . externally adjustable grinding plate and grate bars. Manganese crushing parts and heavy-duty rotor—equipped with multiples of manganese steel shredder rings . . . Metal trap with convenient clean-out. Compactly constructed for minimum headroom requirements. Capacities up to 500 TPH.

Write for illustrated bulletin "Crushing Coal At Less Than One Cent Per Ton."

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

IN SPEEDING UP the fitting of machine parts by eliminating the precision machining otherwise required, Laminum shims actually add to the certainty of uniform accuracy . . . you simply peel laminations of known precision gauge from the solid shim. Bulletin on request.

Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

Laminated Shim Company, Incorporated

61 Union Street • Glenbrook, Conn.

LAMINUM

THE SOLID SHIM THAT peels FOR ADJUSTMENT

78 ELECTRODES—Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. 8-page publication No. WNC-2, "Ampco Welding News," is illustrated with application scenes, diagrams, tables and fact stories relating to welding with Ampco-Trode and Phos-Trode electrodes. This magazine is available to welding engineers, practical welders and production men.

OTHER EQUIPMENT

79 STANDARD RELAYS—Dept 221, Potter & Brumfield Sales Co, 549 W Washington Blvd, Chicago 6, Ill. 24-page catalog contains information on complete line of standard relays and electrical timing devices. Catalog gives applications, selections and capacities of each model.

80 RELAY EQUIPMENT—General Electric Co, Schenectady, N. Y. 4-page bulletin No. GEA-4396 discusses winding-temperature relay equipment with ambient-temperature compensation for overload protection of power transformers.

81 HEAT INSULATION—Plant Rubber & Asbestos Works, 537 Brannan St, San Francisco, Calif. 8-page bulletin, "Plant Precision Molded 85% Magnesia," discusses advantages of this form of heat insulation. Definitions of terms, tables showing sizes and thicknesses are given.

82 PICTORIAL DRAFTING—John R Cassell Co, 110 W 42nd St, New York 18, N. Y. 20-page booklet, entitled "Axonometric Drawing . . . the Universal Picture Language," by Paul F Boehm, explains principles of pictorial engineering drafting, as utilized in isometric and dimetric projection.

France to Purchase U. S. Power Equipment

(McGraw-Hill World News): France plans tentatively to spend about $100 million on foreign electrical generating and distribution equipment during the next four years now that the $1.4 billion Franco-U. S. credit agreement has given the green light to French reconstruction plans. Of the $100 million total, about $65 million is scheduled for purchases of U. S. equipment. The purchases will be coordinated with France's over-all 5-yr reconstruction plan, drawn up by Jean Monnet as head of the Commissariat du Plan de Modernisation et d'Equipment, and designed to increase the total national output to 25% over the 1929 level by 1950.

Hydro power output is to be doubled under this plan, from the 10-billion-kwhr level of late 1945 to more than 20 billion kwhr by the end of 1950. New power plants will be installed at a number of dams to be built on the Rhone River, including the Genessiat dam now under construction. Electrical equipment for the increased hydro power facilities is given a high priority by the French because it will displace coal, which would otherwise have to be imported as fuel for the high-level industrial production planned for 1950.

The French government will buy the equipment as the electric utilities are publicly owned. French government purchases in the U. S. are normally handled by the French Supply Council with offices in New York and Washington.

U. S. government approval will be necessary for some of the purchases. Specifically, any buying from funds of the $650 million Export-Import Bank loan to France awaits final approval by the Export-Import Bank of detailed purchase lists. Civilian Production Administration allocations will be needed for any goods in short supply in the U. S.

Patented Instrument Guides Elimination of 3% Fuel Waste

IMPROVED EFFICIENCY PERMITS 14 TO 32 THOUSAND HORSEPOWER HOURS PER GALLON OF LUBRICATING OIL

Lubrication Engineer's Report

Since 1940 a prominent Midwestern gas company* has been using the patented Cities Service Heat Prover to check the efficiency of their 20 gas engines.

"Early Heat Prover readings showed a 3% fuel waste under full load. Constantly using the Heat Prover to gauge combustion efficiency, corrections were made and maximum fuel utilization was achieved.

"The following recent check on 8 of these engines shows the unusual results. And they're still going strong. The general average on all of these engines is 14 to 32 thousand horsepower hours per gallon of lubricating oil . . . Cities Service Sentry No. 9 and No. 6."

Engine # 9	
Operating Hours Right Side	22006
Left Side	22006
Liner Right Side	80619
Liner Left Side	22006
Engine # 14	
Operating Hours Right Side	17843
Left Side	25002
Liner Right Side	30511
Liner Left Side	30511
Engine # 10	
Operating Hours Both Sides	19353
Liner Right Side	42183
Liner Left Side	42183
Engine # 2	
Operating Hours Right Side	17635
Left Side	17635
Liner Right Side	17635
Liner Left Side	17635
Engine # 11	
Operating Hours Right Side	15324
Left Side	24979
Liner Right Side	15324
Liner Left Side	24979
Engine # 6	
Operating Hours Right Side	14189
Left Side	17627
Liner Right Side	35809
Liner Left Side	14189
Engine # 13	
Operating Hours Right Side	16968
Left Side	24448
Liner Right Side	24979
Liner Left Side	24979
Engine # 7	
Operating Hours Right Side	14332
Left Side	22556
Liner Right Side	30901
Liner Left Side	30901

The Cities Service Industrial Heat Prover has been used successfully with every kind of fuel and with every type of combustion equipment in this country. It indicates simultaneously the percentage of unburned fuel and oxygen present in flue gases. With this data the trained Cities Service engineer can show you at once how to *save* on fuel costs and improve efficiency.

Engineering Service Available

Cities Service Lubrication and Combustion Engineers know ways and means for reducing costs and improving the performance of lubricants. For help or information call the branch office nearest you or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y. (Arkansas Fuel Oil Company, in the South). *Name on request.

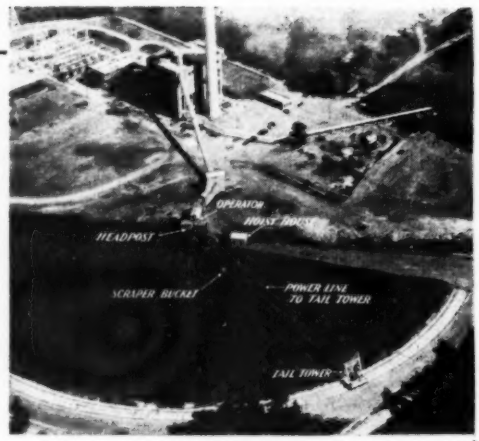
CITIES SERVICE OILS
ONCE-ALWAYS

FOR EVERY LUBRICATION PROBLEM

CALL Cities Service FIRST!

Let ONE man take care of your COAL STORAGE PROBLEMS

If you have a man power shortage, let *one* man be responsible for storing and reclaiming coal — safely — rapidly — economically — with a Sauerman Scraper System.



Sauerman Scraper System, with 8 cu. yd. Crescent scraper operating on 450 ft. radius, handles 200,000-ton stockpile for 140,000 KWH station.

Consider these advantages:

1. Maximum tonnage stored on all available space.
2. Operation is smooth, fast and flexible.
3. Costs only a few cents per ton of coal moved into and out of storage pile.
4. Handles coal cleanly.
5. Stocks in compact layers — no air pockets to promote spontaneous combustion.
6. One man operates with one set of automatic controls.
7. Low original cost to install.
8. Simple and economical to maintain.

The complete Sauerman Catalog is yours for the asking.

SAUERMAN BROS., Inc.
562 S. CLINTON ST. CHICAGO 7, ILL.

DUDGEON HIGH EFFICIENCY TUBE EXPANDERS

Quality-built to lower costs!

It means a lot to the user to know that each DUDGEON expander can be unqualifiedly depended upon to give consistently good results . . . quickly, with less effort. It means a lot to the buyer too, toward lower unit costs and better workmanship. This confidence — implicit in DUDGEON products for almost a century — results from the same modern manufacturing techniques and rigid quality control that have consistently raised the quality and lowered the costs of these fine tools.

DUDGEON TYPE 22

Highest quality tool obtainable for all general tube rolling in railroad maintenance and boiler repair work. Simplified design provides unusual economy of operation. Hardened guide ring bears against hardened one piece frame for maximum resistance against grit and scale. Rollers are reversible.

RICHARD Dudgeon INC.
MFRS. OF TUBE EXPANDERS SINCE 1853
24 COLUMBIA STREET, NEW YORK 2, N. Y.

Complete literature on Dudgeon products — expanders, hydraulic pumps and jacks — available. Write today. Address inquiries to Department G

APPOINTMENTS

Lincoln Electric Co added the following to its staff: (1) Gordon Appleby joined the welding engineering staff of Philadelphia branch office. (2) Terril S Hoffman has been assigned welding engineer in St. Louis area. (3) E James Langhurst was named welding engineer in Chicago territory. (4) Garret S Parsons returned to Los Angeles branch office after Army service.

R N Landreth, assistant to vice-president, general machinery div, **Allis-Chalmers Mfg Co,** has been named to direct activities of Washington, D. C., district office in addition to other duties. Ralph R Newquist resigned as manager of Washington office.

Atlas Lumnite Cement Co has been merged into Universal Atlas Cement Co. Both companies are wholly owned subsidiaries of U. S. Steel Corp. Organization of former Atlas Lumnite Cement Co will be known as **Lumnite div, Universal Atlas Cement Co,** with headquarters at 135 E 42nd St, New York 17, N. Y. Manufacture and sale of Lumnite will be continued under direction of Joshua L Miner, vice-president, Lumnite div.

Electric Machinery Mfg Co appointed Russell Ranson, 116½ E 4th St, Charlotte 2, N. C., as sales representative for N. C. and S. C.

E W Manterfield Jr has been appointed to public relations staff of **American Locomotive Co.** He will serve under Holmes Brown, director of advertising, with headquarters at 30 Church St, New York City.

Fairbanks, Morse & Co announces retirement of A E Ashcraft, vice-president in charge of manufacturing. Mr Ashcraft continues to be a director of the company. C H Morse III, vice-president, has been placed in charge of all manufacturing plants and operations. Henry M Haase has been made manager of Beloit, Wis., works, following resignation of A C Howard.

J W Weingartner has been appointed production-control manager of **Brown Instrument Co.** He will also direct purchasing. Charles Goodman has taken over duties of purchasing agent under Mr Weingartner's supervision and William Lawson has been named assistant production-control manager.

A M MacCutcheon retires as senior vice-president of **Reliance Electric & Engrg Co.** He will act as consultant to the co.

Westinghouse Electric Corp announces election of W O Lippman as vice-president. Mr Lippman will be responsible for all plant labor relations. He will report to L E Osborne, senior operating vice-president. Vice-President W G Marshall, in addition to his administration of company-wide industrial relations, has been assigned increased responsibilities for community and public relations.

Appointment of C D Kester as manager of York, Pa., office of **Westinghouse Electric Corp** was announced recently. Mr Kester succeeds E M Powell who has been made

ONE *recognized standard*

THE COTTRELL PROCESS OF ELECTRICAL PRECIPITATION

FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

RESEARCH CORPORATION

NEW YORK 17: 405 LEXINGTON AVENUE
CHICAGO 3: 122 SO. MICHIGAN AVENUE

HERCULES
SEAMLESS COPPER
FLOATS
HERCULES

GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications — to give long, dependable, economical service. Insure carefree maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

IMO—
The PUMP for
SMOOTH
FLUID FLOW

The steady, uniform flow produced by the rotors in an IMO pump is ideal for oil burner supply, hydraulic service and other applications requiring an even, smooth flow of fluid.

For information send for catalog I-133-P

IMO PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

machinery electrification manager of the district. H A Klug became merchandise manager and J B Baughman product supervisor in refrigeration specialties dept at E Springfield, Mass., works.

Harold C Hickock has been made central district manager of **B F Sturtevant Co,** div of Westinghouse, with headquarters in Pittsburgh, Pa. Dallas W Norris assumes post vacated by Mr Hickock as central district manager of elevator div of Westinghouse in Pittsburgh.

Progressive Welder Co appoints Clifford M Manzer as chief engineer. Walter L Jewett has been made manager of development engineering, reporting directly to Fred H Johnson, president.

Alfred B Drastrup has been elected manager of alloy-steel sales dept of **A M Byers Co,** Pittsburgh.

Edwin M Allen has retired as chairman of board of **Mathieson Alkali Works.** He will continue as a director of company.

Penn Industrial Instrument Corp announces election of J T Vollbrecht as a director.

Chester P Ford has been named divisional manager of mid-western area of Penflex Sales Co, newly formed sales organization of **Pennsylvania Flexible Metallic Tubing Co.** His headquarters will be in Chicago. The sales area will extend from Canadian border to Gulf of Mexico and from Pennsylvania western border to Denver.

Jarvis Equipment Co, 795 E McMillan St, Cincinnati, O., has been appointed district agents of **Warren Steam Pump Co.** Jarvis will represent Warren centrifugal and reciprocating pumps in Ky. and southern sections of O., Ind. and W. Va.

Economy Pumps, Inc, purchased the stock of Klipfel Mfg Co. J H Swan remains with Klipfel in an advisory capacity and as chairman of board.

Southern States Euipment Co has elected Purser & London, Ltd., Charlotte, N. C., as representative in that state and in S. C.

Appointment of John C Morris as superintendent of manufacturing of resin and insulation materials div of **General Electric Co** chemical dept has been announced. Harry K Collins becomes manager of div.

Charles K West, commercial vice-president of **General Electric Co** in charge of Atlantic district with headquarters in Philadelphia, retired July 1 after more than 47 years of service. O F Haas succeeds Mr West in charge of Atlantic district.

General Electric Co appoints C N Bristol superintendent of York, Pa., Boundary Ave works of wiring device div. G R LaWall becomes quality control engineer in wiring device and accessory equipment divisions. F B Ennis has been made manager of manufacturing of wiring device div. Mr Ennis announced appointment of seven offi-

See how RANAREX* cuts up-the-stack heat loss

You can save as much as 20% on up-the-stack heat loss with Ranarex. This instrument measures flue CO_2 accurately, showing *instantly* when furnace needs regulating.

Ranarex contains no chemicals or delicate parts, yet it's accurate to within 3/10 of 1%. Install this valuable fuel-saver before more heat goes up the stack!

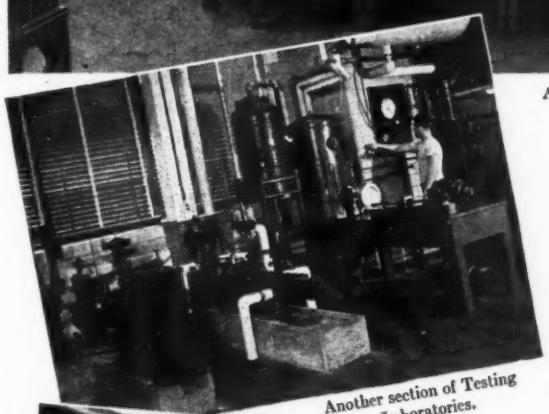
FREE BOOKLET

. . . on request. Write to The Permutit Company, Dept. PR8, 330 West 42nd St., New York 18, N. Y.

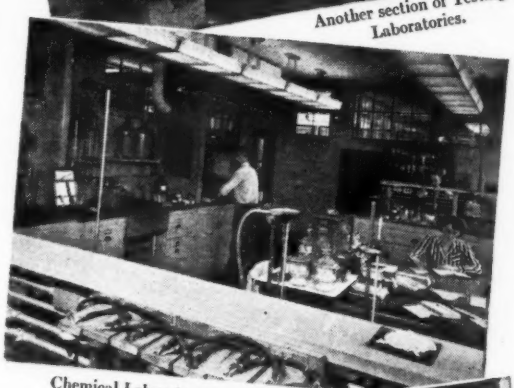
*Trademark Reg. U. S. Pat. Off.

RANAREX
PRODUCT OF
PERMUTIT

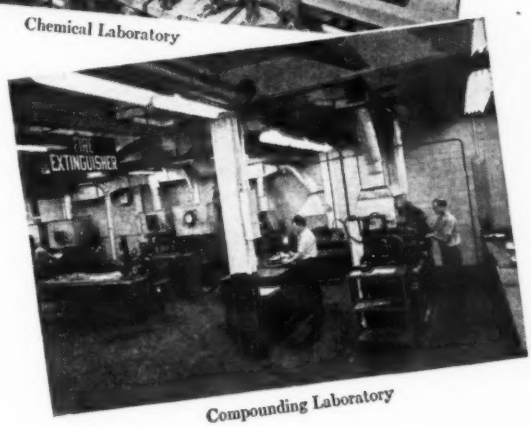
Above—Garlock Testing Laboratories, general view.



Another section of Testing Laboratories.



Chemical Laboratory



Compounding Laboratory

New, Modern Facilities—

For developing, improving and testing Garlock products

YEARS AGO, when little was known about the laws governing "packing mechanics," The Garlock Packing Company entered into research in the field of mechanical packings. Year by year, as new industrial equipment and processes came into use, Garlock's research expanded.

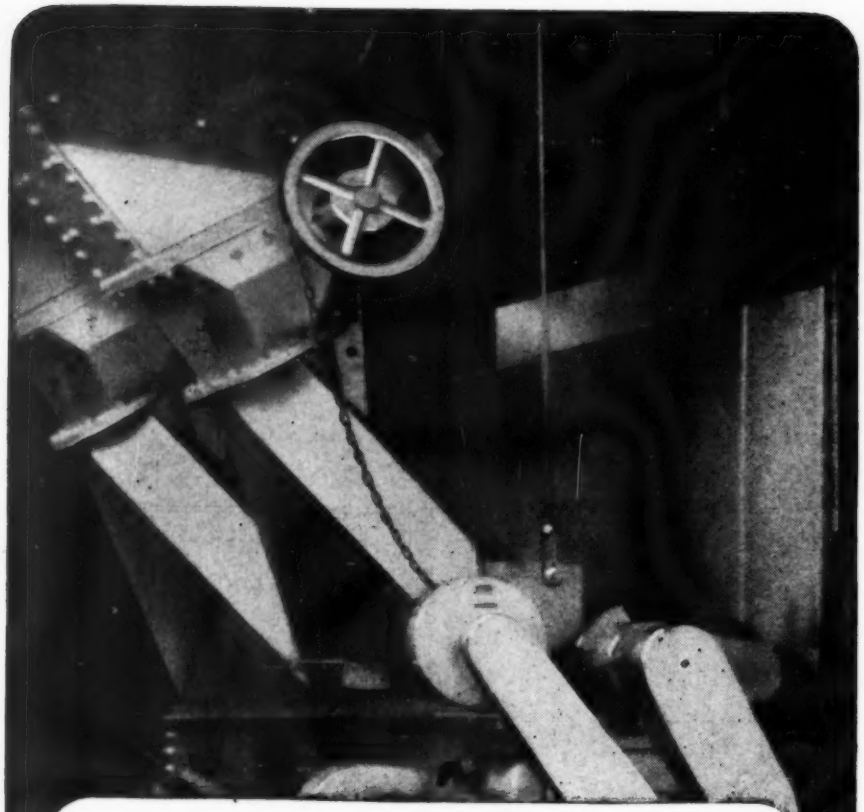
Garlock's latest forward step in that direction is a new modern, building at Palmyra housing a chemical laboratory with complete analytical and microscopic facilities; a physical laboratory; a rubber-compounding laboratory; an extensive test department; and a fully equipped pilot plant. These new facilities are staffed with able and experienced technicians whose entire time and efforts are devoted to the development of new products and processes; the improvement of old products; and the repeated testing under actual operating conditions of GARLOCK packings, gaskets and KLOZURE oil seals.

Every Garlock product is Quality Controlled from the raw material to the final finishing operation and has a background of scientifically measured performance. More than ever before Garlock merits its slogan—*The Standard Packing of the World.*

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada:
The Garlock Packing Company
of Canada Ltd., Montreal, Que.

GARLOCK



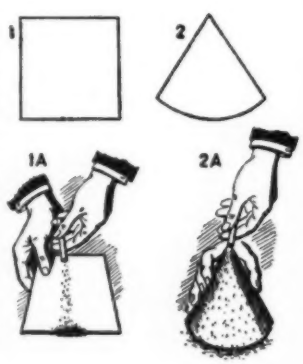
CONICAL Non-Segregating Coal Distributors

feed coarse and fine coal *without segregation*

Make this test . . . See the proof for yourself!

Cut two pieces of note paper in the shapes shown in Fig. 1 and 2. The square piece represents a flat coal chute—and the pie-shaped piece, the CONICAL Distributor. Now, holding the square piece of paper tilted sharply, roll a cigarette between your fingers, sifting tobacco onto the inclined surface. Note that the tobacco slides straight down the center and forms a pile. The fines sift through the center and the coarse rolls to the sides.

Now hold the pie-shaped piece so as to form a cone segment and repeat the sifting operation. (Be sure you have a cone). Watch the large and small particles begin distributing themselves early in their fall and note that both large and small particles land uniformly spaced and evenly distributed at the base of the cone. CONICAL Distributors give better firing and lower stoker arch maintenance. For more information, write Stock Engineering Co., 715 Hanna Bldg., Cleveland 15, Ohio.



STOCK ENGINEERING CO.

★ CONICAL Non-Segregating Coal Distributors ★ S.E.CO. Coal Valves and Coal Scales

cials in GE plants under his jurisdiction: (1) J R Murray is now assistant manager of manufacturing of wiring device div and superintendent of wiring device section. (2) C A Devore has been named manager of Mt. Vernon, N. Y., works. (3) H R Geiman is now manager of Meriden, Conn., works. (4) E G Hopkins becomes manager of Norfolk, Conn., works. (5) R L Priestley is manager of the new Saugerties, N. Y., works. (6) W A Scott has been named manager of Millerton, N. Y., works. (7) H B Turner becomes manager of Lowell, Mass. works. W Luther Lewis succeeds H A Jackson as president of **Chicago Pneumatic Tool Co.** Mr Jackson was re-elected chairman of board of directors.

Thermoid rubber div of **Thermoid Co** announces appointment of Edward C Hoeflich as industrial sales promotion manager.

Richard C Baker has become associated with **Timken Roller Bearing Co** as an executive assistant.

Perfex Corp opened branch offices at Cleveland and Detroit. Charles M Campbell is in charge of the Cleveland branch, located at 2010 E 102nd St. Detroit office at 9545 Grand River Ave is under supervision of S David Horner.

Monsanto Chemical Co promotes Sam R Clement to assistant general manager of sales, phosphate div, St. Louis.

Appointment of Walter C Kerrigan as manager of nickel sales dept of **International Nickel Co,** to succeed the late Rudolph L Suhl, is announced.

Wm W Nugent & Co appointed following representatives: Leekley & Hergenrather, 639 S Wilton Pl, Los Angeles 5, Calif.; Brundage Supply Co, 192 Front St, New York 7, N. Y.; Acme Engineers, 730 M & M Bldg, Houston 2, Tex.; General Equipment Co, 3908 Olive St, St. Louis 8, Mo.; and John H. Doerner, 111 E 4th St, Cincinnati, O.

Robert H Owens becomes vice-president in charge of engineering and manufacturing of **Roots-Connersville Blower Corp.**

Among engineers recently assigned by **Foxboro** Co to sales or service work in various territories are the following: (1) Paul A Hilli, resident engineer, Hartford, Conn. (2) John M Waters, sales engineer, reopening Birmingham, Ala., office (3) John W Fulton, service engineer at Chicago (4) Robert E Rogers, branch manager, Los Angeles (5) Richard P Parshall, sales engineer at Chicago (6) Edward E Pettibone, sales engineer at Cleveland (7) Hubert Gordon Morgan, sales engineer at Cincinnati (8) John L Pierce, sales engineer at Atlanta, covering Florida and Carolina territory (9) John W Garden, sales engineer at Pittsburgh (10) Joseph J Connelly, sales engineer at Chicago (11) Mark B Bagley, service engineer at Los Angeles.

American Foundry Equipment Co appointed George C Tolton sales representative for Northwestern states, with headquarters in Seattle, Wash. Anthony Stimmler

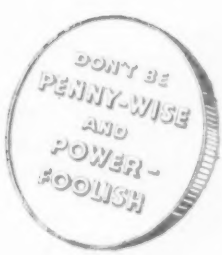
Wire ahead!

to keep in step

HERE is a picture of what *can't* happen if the split-second coordination, for which automobile plants are famous, is to prevail.

But it can happen, and it *will* happen in any plant without adequate wiring. For, when obsolete wiring, overtaxed wiring, over-extended wiring can reduce the efficiency of man and machine by 25 to 50 per cent, production is reduced accordingly. With lost production, you can't keep in step with competition.

It may pay you to check on your wiring at once. Ask your plant power engineer, consulting engineer, electrical contractor or power salesman. A wiring survey now may save costly shut-downs and expensive alterations later. 46200



ANACONDA

ANACONDA WIRE & CABLE CO.

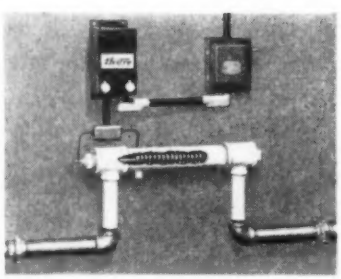
Kirk McWatters
says
"See our exhibit at
the
National Power Show
Cleveland Public Auditorium - August 19th to 22nd
SPACE No. 4"

Eliminate Scale and Corrosion with
THE Electrol WATER CONDITIONER

Prevents lime deposits, scale formation, corrosion, foaming, priming and bumping. Embrittlement and cracking are alleviated—pitting is unknown.

Eliminates boiler compounds and harmful chemicals with their periodic cleaning shutdowns. Algae and foreign growths are stopped immediately.

Reduces full costs maintenance expense and the number and length of shutdowns for cleaning boilers and lines.



A simple installation (shown above) between the preheater and injector pump or between injector pump and the boilers is all that is required.

STOMAC ENGINEERING CO. Inc.
2012 W. 25th St. Cleveland 13, Ohio.
Branch Offices: 726 Empire Building Milwaukee 3, Wisconsin
506 S. Wabash Ave. Chicago, Illinois

will represent the company in new Minneapolis sales office. Mitchell P Christensen has been made sales representativ in newly created Denver territory, with headquarters in that city.

New location of administrative staff and plant headquarters of **Detrex Corp** is at 14331 Woodrow Wilson Ave, Detroit, Mich. B C O'Brien becomes president and general manager of **Bury Compressor Co.**

Dan W Holmes joined **Parker Appliance Co** as general sales manager.

John Bess, president of Refrigeration Corp of America, a subsidiary of **Noma Electric Corp,** was elected a vice-president of the parent company at annual meeting of Noma directors at which other officers were re-elected. Mr Bess is also a director of Noma. Howard S Fisher, formerly assistant secretary of Noma, was elected secretary of the company and other new appointments by the board were James A Marohn, assistant treasurer, and Etta Ribbler, assistant secretary.

Joseph H Ward, executive vice-president of **Noma Electric Corp,** has been assigned new responsibilities as sales director and supervisory officer for all of Noma's manufacturing and sales divisions and subsidiaries, with exception of those engaged in household durable goods field and automotive lighting. Mr Ward has been placed in charge of six divisions and ten subsidiaries.

Corporate name of Triumph International, Inc, subsidiary of Noma Electric Corp engaged in export-import sales, has been changed to **Noma International, Inc.**

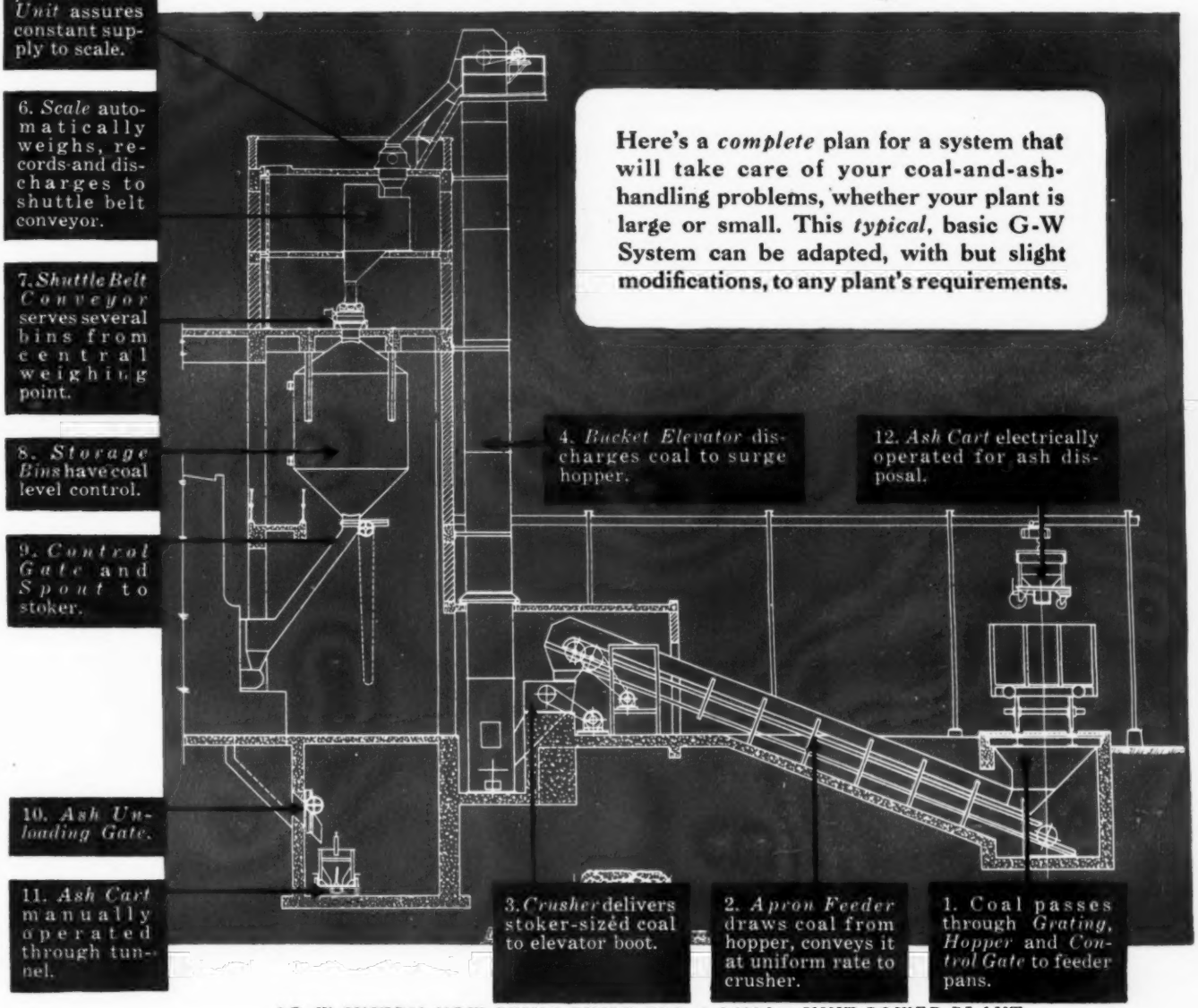
Assignment of territories to new district representatives of Thermo-Aire div of **Evans Products Co** is announced: Ralph E Oursler will be central Midwest representative, with headquarters at 1811 S Mill St, Kansas City, Kan. His territory will include Kan., Mo., Iowa, Neb., Okla. and southern Ill. R A Lennox will be northern Midwest representative, with headquarters at Sales Engrg Service, 2400 W Madison, Chicago, Ill. Mr Lennox will represent Evans in northern Ill., Wis., Minn., western and upper peninsula of Mich.

Bert Holub organizes **Holub Industries, Inc,** Sycamore, Ill. Products offered by the new company include electric blowers, industrial cleaners, wire connectors, fuse clip clamps, fuse pullers, fuse reducers, electric testers, wire strippers, etc.

Springfield Boiler Co announces election of George R Atherton as president to succeed Owsley M Brown, who has retired. Other officers announced by the company in the reorganization are Ross Irwin, vice-president and chief engineer; John Pratt, secretary and assistant treasurer; and C G Smith, assistant secretary.

Clayton N Ward and John A Strand announce that they have formed a new firm of consulting engineers under name of **Ward & Strand.** The firm will engage in

This *one* basic blueprint* solves *all* problems in coal-and-ash-handling


5. Surge Hopper Control Unit assures constant supply to scale.
6. Scale automatically weighs, records and discharges to shuttle belt conveyor.
7. Shuttle Belt Conveyor serves several bins from central weighing point.
8. Storage Bins have coal level control.
9. Control Gate and Spout to stoker.
10. Ash Unloading Gate.
11. Ash Cart manually operated through tunnel.
Here's a complete plan for a system that will take care of your coal-and-ash-handling problems, whether your plant is large or small. This typical, basic G-W System can be adapted, with but slight modifications, to any plant's requirements.
4. Bucket Elevator discharges coal to surge hopper.
12. Ash Cart electrically operated for ash disposal.
3. Crusher delivers stoker-sized coal to elevator boot.
2. Apron Feeder draws coal from hopper, conveys it at uniform rate to crusher.
1. Coal passes through Grating, Hopper and Control Gate to feeder pans.

*G-W SYSTEM NOW BEING BUILT FOR A 2,000 kw. UNIT POWER PLANT.

COAL IN... ASHES OUT

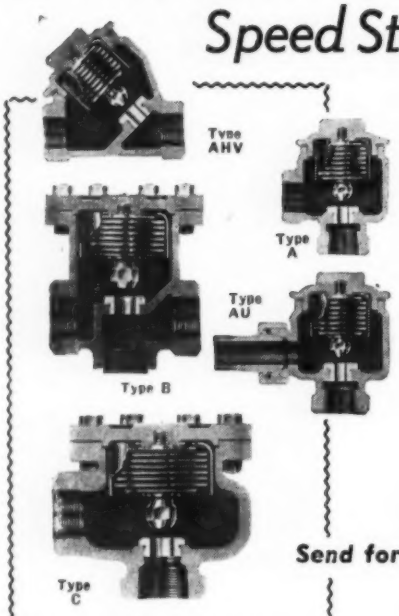
HANDLING HEADQUARTERS
for Industrial Conveying and Elevating Equipment . . . for Infra-Red Baking and Drying Equipment . . . for Ice Handling Tools and Ice Processing Machines.

G-W HANDLES IT...
faster • easier • cheaper

G-W will do the complete job. From start to finish G-W shoulders full responsibility for all details of design, manufacture, and erection. You save the time and money usually spent in dealing with sub-contractors. Two-way assurance that G-W will install the coal-and-ash-handling equipment that's best for your plant: hundreds of satisfied G-W equipment users; more than 130 years' experience in designing material-handling equipment for all types of industries. Gifford-Wood Co., 420 Lexington Ave., New York 17, N. Y.; 565 W. Washington St., Chicago 6, Ill.—Factory: Hudson, N. Y.

GIFFORD-WOOD
SINCE 1814

6 "Power-full" Reasons Why
NICHOLSON TRAPS
Speed Steam Circulation



1. **BIG DISCHARGE CAPACITY.** 2 to 6 times that of average traps.
2. **NO AIR BINDING.** Discharge air as efficiently as water.
3. **NO FREEZE-UPS.** Of thermostatic bellows type; drain completely when cold.
4. **NO DRIBBLING.** Close immediately when steam contacts bellows.
5. **NO ADJUSTMENT NEEDED,** from vacuum up to maximum pressure.
6. **NO WATER-LOGGED UNITS** A few degrees change opens valve.

Five types: size ¼" to 2". Pressures to 225 lbs. Low cost. Designed for severe service.

Send for Catalog 444 or See Sweet's

W. H. NICHOLSON & CO.
125 Oregon St., Wilkes-Barre, Pa.

Here's **PROOF** That

NCC **SLUDGE SOLVENT AND FUEL OIL CONDITIONER**

1. Dissolves even the hardest sludge
2. Contains no caustic
3. Is acid-free

Simple, easy tests made on your desk furnish the proof. Engineers of factories, ship lines, railroads confirm it. A trial order will clinch it for you, too.

HOW TO MAKE THE TESTS

FOR SLUDGE—Place some sludge in a saucer (a scraping from the fill pipe is an easy way to get some). Add enough NCC to cover completely. Right before your eyes you will see the sludge dissolve.

FOR ACID—The accepted test for acid in a liquid is the addition of Methyl Orange which turns the tested liquid pink if it contains acid; yellow, if acid-free. NCC turns yellow, proving that it is neutral and acid-free.

FOR CAUSTIC—The accepted test for caustic in a liquid is the addition of Phenolphthalein which turns the tested liquid pink if it contains caustic. NCC remains water-white, proving that it contains no caustic.

A sample of NCC, to enable you to make these tests, will be sent postage-paid and FREE. Please write on your company letterhead. The few drops of Phenolphthalein and Methyl Orange can be bought in any drug store.

NUTMEG CHEMICAL CO., 223 State St., New Haven 10, Conn.

engineering projects involving water, diesel and steam power, waterworks, sewerage works, flood control, irrigation and drainage, hydraulic research and hydrological investigation. Temporary address of firm is 550 State St, Madison 3, Wis.

Frank V Smith, a partner of **Sargent & Lundy,** has been appointed chief electrical engineer of the firm, succeeding Francis H Hollister who has retired.

Rolland W Simpson, sanitary engineer, has joined staff of **Gilbert Associates, Inc,** engineers and consultants, located in Reading, Pa., with offices in New York City, Washington, D. C., and Philadelphia. John G Miller will serve as a mechanical engineer in offices at Reading, Pa.

Bertram J Cross has been designated to take over management of development and research dept of **Combustion Engrg Co,** succeeding the late Henry Kreisinger. Theodore A Dyke has been made manager of export div. He succeeds the late J B Crane.

Geo P Reintjes Co announces appointment of Herbert L MacElroy as New England representative, with offices at 7 Water St, Boston, Mass.

Arthur J Koch has been made assistant sales manager of **Hammel-Dahl Co,** Providence, R. I.

Warren Steam Pump Co announces appointment of O'Brien Specialty Co, Syracuse, N. Y., as their agent for upper New York State.

A L Baker has been elected vice-president and W H Denn Jr general manager of **Kellex Corp.** This corp is a subsidiary of M W Kellogg Co.

Allegheny Ludlum Steel Corp announced licensing of Darwins, Ltd, large British steel producer, for manufacture and distribution of the local company's recently developed high-temperature alloys.

Saul Belilove has been added to sales dept of **Enterprise Engine & Foundry Co's** diesel engine div.

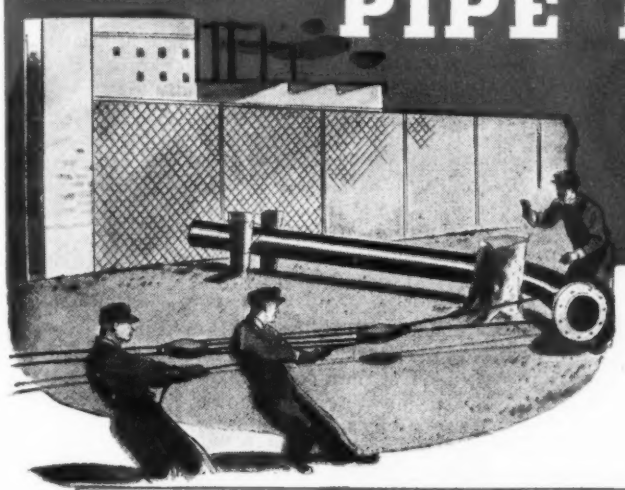
Turco Products, Inc, announces the affiliation of Donald Keating with their technical service staff.

Jared P Morrison, consulting engineer of **Hartford Steam Boiler Inspection & Insurance Co** and for 45 years a member of its staff, retired from duty in June.

John L Carruthers has been named chairman of dept of ceramic engineering at **Ohio State University,** succeeding Arthur S Watts who is retiring.

Industrial Research Institute, Inc, elected C S Venable, director of chemical research, American Viscose Corp, Marcus Hook, Pa., as president; and N A Shepard, chemical director, American Cyanamid Co, New York, N. Y., as vice-president. C G Worthington was reappointed secretary and treasurer. E W Engstrom, vice-president, RCA Laboratories div, Radio Corp of Amer-

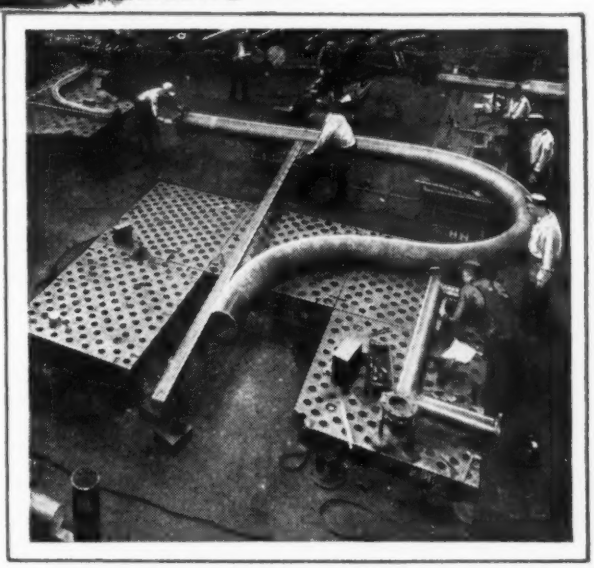
PIPE FABRICATION
Is Not a "Back Yard" Job



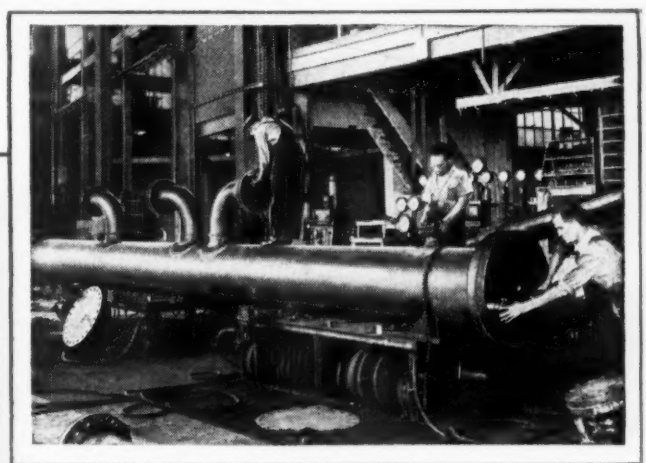
If pipe fabrication looks like an easy skill which can be picked up and practiced at odd times in the back yard, consider these facts: Qualified pipe fabricators report that it takes years to train skilled mechanics such as pipe benders . . . and years to develop competent piping layout men.

Expensive equipment is needed if a job is to be done satisfactorily and economically . . . layout tables . . . bending equipment . . . Van Stone machines . . . rotating fixtures and jigs for welding . . . furnaces for heat treating and stress relieving . . . machine tools . . . testing equipment . . . etc. A subassembly which looks relatively simple may require the use of equipment representing a very large investment.

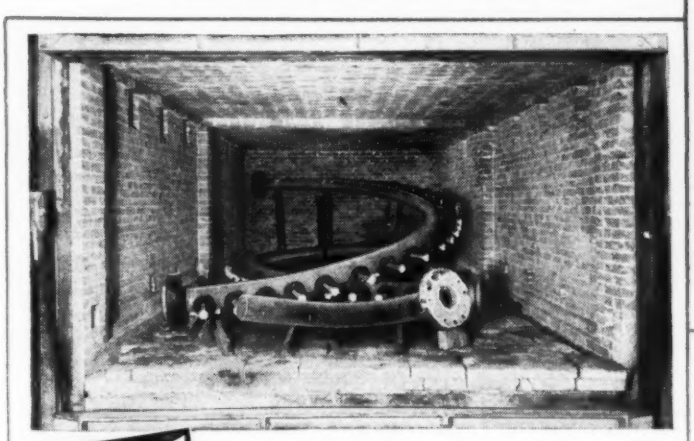
Pipe fabrication is not a back yard job—it is a difficult art which requires skill, special training, experience, and plenty of equipment. Qualified pipe fabricators have the well-equipped shops staffed with the highly skilled men necessary to meet today's exacting pressure piping requirements.



Layout and squaring tables used by qualified fabricators for more accurate piping.



Testing in the shop of the qualified pipe fabricator saves time in the field.



Furnace for heat treating alloy piping and stress relieving shop- welded subassemblies.

P.F.I. THE PIPE FABRICATION INSTITUTE

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

F-6

MAKE UP THE DIFFERENCE
with these fuel-saving traps

CHECK YOUR TRAPS NOW

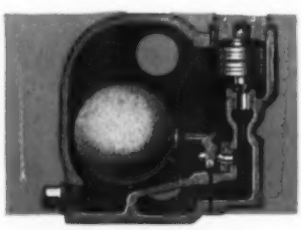
Sediment accumulations, worn seats and pins, "dead" thermostats—any one of these may be causing a serious loss of steam. The only way to guard against this waste is to open up your traps—*once a year at least*—and eliminate the troublemakers. Remember that the tiniest steam leak, during a year's operation, can waste an unbelievably large amount of fuel.

The fuel shortage loses most of its terrors when the remarkable results being accomplished by steam plant modernization are considered. In plants the country over, replacing worn out, inefficient equipment is enabling operators to maintain full heat requirements on reduced amounts of fuel. Modernization of heating equipment cannot be considered an expense, but a safe investment paying substantial dividends in fuel saved and a protection against production loss.

Hoffman Steam Specialties make any heating plant modernization a genuine success. Not only are they recognized as highly efficient units, but they have features which amazingly prolong service life.

Quality has real meaning when applied to Hoffman Steam Traps. They are so constructed that all parts subject to wear can be easily and inexpensively renewed—no need to junk an entire unit because of a worn seat. They have non-corrosive thermostats, capable of standing up under countless flexings and high temperatures. All together, these traps are a rare combination of sound design and excellent material, assembled with genuine pride in good workmanship.

Write today for Hoffman Trap Catalog.



HOFFMAN 50 SERIES TRAP

This heavy duty trap does a precision job under toughest service. All working parts are mounted on cover—*easily removed for cleaning without breaking pipe connections.* Reversible pins and seats assure long life.

HOFFMAN NO. 8C TRAP

An all brass trap for radiators and other low pressure jobs. Thermostat consists of non-corrosive alloy diaphragms, full spring, for long life under countless flexings. Tough, special alloy pin. Thermostat and seat are renewable.

Guardian of Your Fuel and Comfort

HOFFMAN
VALVES • TRAPS • PUMPS

HOFFMAN SPECIALTY CO., 1001 YORK ST., DEPT. P-8, INDIANAPOLIS 7, IND.

Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems . . . Sold by leading wholesalers of Heating and Plumbing equipment.

ica, Princeton, N. J., and J H Schaefer, vice-president, Ethyl Corp, New York, N. Y., were elected to serve 3-yr terms on board of directors.

Arthur E Stanley has resumed his duties as a partner with **Stanley Engrg Co,** Muscatine, Iowa, after service with Army.

E D Benton has been named to staff of **Battelle Institute,** Columbus, O., where he will be engaged in research on utilization of fuel in locomotives.

Charles W Kellogg retired as president of **Edison Electric Institute.** A B Morgan has been promoted to assistant managing director. He will assist H S Bennion, vice-president and managing director, in supervision of operations and will also continue his present responsibilities. Harry E Kent has been appointed director of engineering, succeeding Alexander Maxwell who has retired.

J Elmer Housley, district power manager, Aluminum Co of America, Alcoa, Tenn., was elected president of **American Institute of Electrical Engineers** for the year beginning Aug 1, 1946. Other officers elected were: Vice-Presidents E W Davis, Cambridge, Mass.; O E Buckley, New York, N. Y.; T G LeClair, Chicago, Ill.; R F Danner, Oklahoma City, Okla.; C F Terrell, Seattle, Wash.; Directors J F Fairman, New York, N. Y.; R T Henry, Buffalo, N. Y.; E P Yerkes, Philadelphia, Pa.; Treasurer W I Slichter, Schenectady, N. Y. (re-elected).

National Association of Power Engineers elected J Wesley Jessup, president; James A Witherow, vice-president; Charles Banks, treasurer; Russell Litchard, corresponding secretary; Roy F Doherty, recording secretary; W G Wark, doorkeeper; John McKay, financial secretary; and John Donald, conductor.

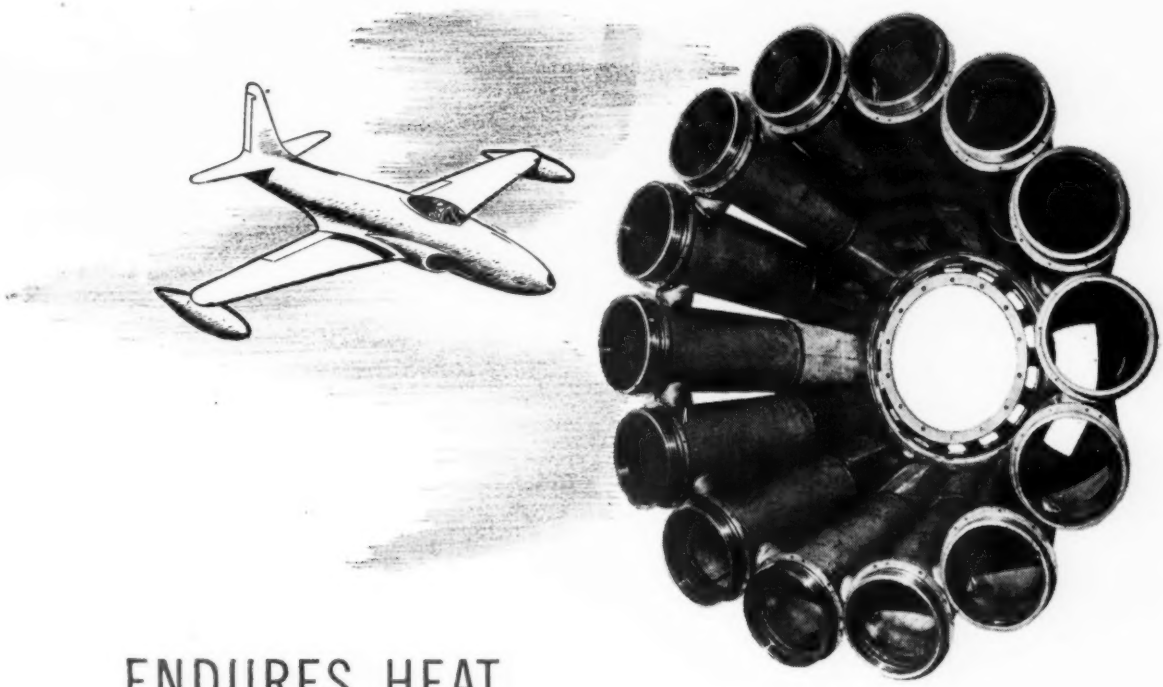
Brahna Chalefman Hutchins has been made president of **Safety Research Institute, Inc.** Other officers elected at same time are Frank Arnoldi, vice-president; Robert Nathans, vice-president; and Angela B Daniels, secretary and treasurer. The four officers were also elected directors.

H A Bruno & Associates have been named public relations counsel to Rogers Diesel & Aircraft Corp and its subsidiaries and affiliates.

Joe Rogers has joined **Julius G Berens** organization, public relations, 101 Park Ave, New York, N. Y., as senior account executive.

Vernon H Van Diver has opened his own business as merchandising and advertising counselor with offices in McGraw-Hill Bldg, New York, N. Y. He will also head the Brad-Vern Co, advertising agency at Garden City, N. Y.

Dewey Abell, chief engineer of generating plant of **Lawrence Gas & Electric Co,** Lawrence, Mass., retired from that post on June 1 after 60 years of service.



ENDURES HEAT

Burner for jet engines made of stainless steel

This assembly of 14 combustion chambers is part of a jet engine through which fiery gases flow at temperatures over 1,500 degrees Fahrenheit. To withstand these high temperatures, and also the corrosive attack of the combustion products, this entire burner unit and various accessory engine parts are constructed of stainless steel. This ideal combination of heat endurance and corrosion resistance makes stainless steel the best metal for countless other types of equipment too — ranging in size and shape from huge chemical reaction towers to frying pans for your kitchen stove.

Ask to receive our monthly publication ELECTROMET REVIEW if you would like to keep informed of these various uses of stainless and other alloy steels. Or, if you need advice on their production, properties, and fabrication, consult our Technical Service Department. While we do not make alloy steels, or any other kind of steel, we do manufacture the ferro-alloys used in their production. Consequently, through years of research and engineering, we have acquired a fund of information that may be of benefit to you.

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

STAINLESS STEEL

BEAUTIFUL ENDURING STRONG TOUGH

Type DA-31 Pressure Control

MERCURY SWITCH
Hermetically sealed mercury switch is used. They cannot be affected by dust, dirt or corrosion; nor are they subject to open arcing, oxidation, pitting or sticking of contacts, all common causes of contact trouble. This switch will give better control service and longer control life.

BOURDON TUBE
(Hidden back of cover)
The Bourdon tube is the actuating element of the control. It is the oldest known, tried and proven element, having been used in gauges for many years.

OUTSIDE ADJUSTMENT
The outside double adjustment with the calibrated dial and pointers is a convenient feature, making it very easy to set the required operating range, plainly visible on the dial. All guesswork is eliminated.

GLASS FACE
The glass face on the cover permits seeing the entire operation of the control in plain view. One can always tell whether the switch circuit is open or closed, a great convenience whenever servicing becomes necessary.

Consult Mercoid on pressure, temperature, liquid level or automatic mechanical control problems.

THE MERCOID CORPORATION
4201 Belmont Avenue
Chicago 41, Illinois

THE ASSURANCE OF DEPENDABLE SERVICE BUILT IN EVERY MERCOID CONTROL

OBITUARIES

Charles H Blodgett, 65, stationary engineer, Public Works Dept. Rochester, N. Y., died June 27.

Leroy W Hutchins, 57, died June 21 in New York City. Mr Hutchins was president of Sheldon, Morse, Hutchins and Easton, Inc, of New York. He was also president of Hutchins & Graves, Inc, and managing director of Safety Research Institute, Inc.

William H Krause, 61, a stationary engineer in Syracuse, N. Y., for 37 years, died June 19. He was past president of National Association of Power Engineers.

Rudolph L Suhl, 64, manager of nickel sales dept of International Nickel Co at New York, died June 10 at his home in Plainfield, N. J.

George H Middlemiss, 59, engineer in charge of production and transmission of interconnected southern properties of Commonwealth & Southern Corp. Birmingham, Ala., died June 10.

Charles E Cummings, 79, assistant secretary of Raybestos-Manhattan, Inc. Passaic, N. J., died June 6.

Eric E Sommer, 34, sales engineer, new products div. Linde Air Products Co, New York, N. Y., was one of the victims of La Salle Hotel fire in Chicago on June 5.

George E Gottwald, stationary engineer in Syracuse, N. Y., died recently at his home there.

Albert Toller Goward, 74, who retired last year as vice-president of British Columbia Power Corp, died recently at his home in Victoria, B. C., Can.

Edgar L Feininger, of Schenectady, assistant general manager of chemical dept of General Electric Co, died recently. He was 56 years old.

LIMA, PERU *(McGraw-Hill World News)*: Government engineers now are surveying a site on Maranon River in northern Peru where it would be possible to construct a hydroelectric project to develop 4,000,000 hp, said to be the greatest volume of power yet known for a single dam. To be located in the Pongo de Manseriche, or Manseriche Narrows, near Borja, the dam would require a relatively small amount of concrete pouring as it would be placed in the Huacanqui Gorge where the steep compact sandstone walls are only 230 ft wide.

Another major project being studied is the development of a 1,000,000-hp hydroelectric station on Mantaro River in Dept of Huancavelica. It would utilize a fall of 3218 ft between points 11 mi apart.

Peru's first major hydro project is under construction on Santa River, 90 mi inland from the Pacific port of Chimbote, where expected capacity is 126,000 kw (POWER, Jan 1945, pp 90 and 91). Shortages of materials have delayed work, but cost is expected to be around $66 per installed kw when completed. Santa station is part of a regional development, which includes irrigation of 250,000 desert acres, exploitation of coal resources and possible construction of a steel plant.

solved by Oakite

Time-Saving Way to Clean Heat Exchangers

Periodic cleaning of heat exchangers is a necessary power plant maintenance procedure. Unless this is strictly scheduled, sludge and scale deposits build up on the tube and shell surfaces, and retard normal heat transfer, lower operating efficiency . . . boost operating costs.

You can effectively remove such deposits with specialized Oakite alkaline, solvent or inhibited acidic type materials specially designed to desludge and de-scale quickly, safely. Used either by circulating, immersion or steam-detergent cleaning methods, Oakite materials and techniques make short, easy work of removing oil, grease, slime, lime scale and rust to help restore equipment efficiency.

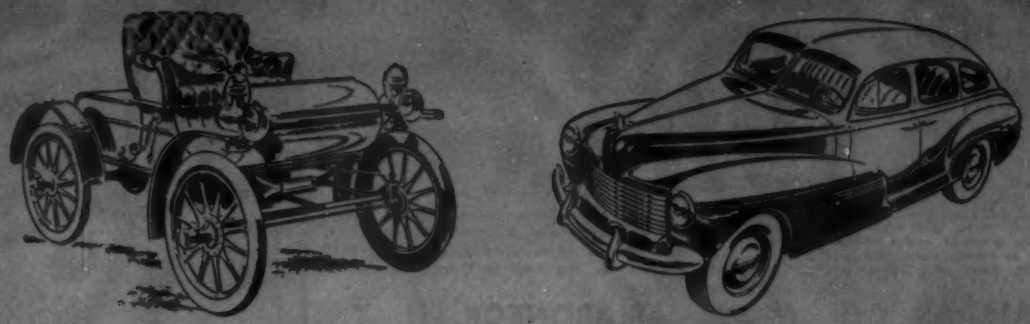
FREE Technical Data!

A new, third edition of the Oakite Power Plant Digest gives detailed Oakite techniques for cleaning oil coolers and heaters, jacket water coolers, feed water heaters, evaporators and other heat exchange equipment. This fact-filled Digest is yours for the asking. Write on letterhead for your FREE copy TODAY!

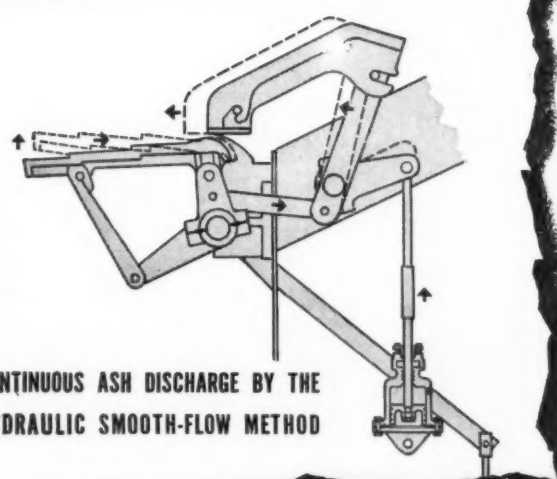
OAKITE PRODUCTS, INC.
23 Thames Street, New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**
MATERIALS • METHODS • SERVICE

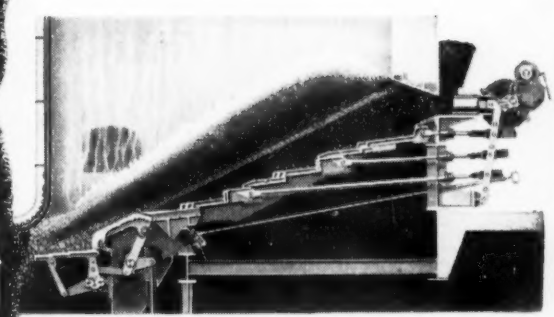
What a Whale of a Difference!



. . . BUT THE BASIC PRINCIPLE IS STILL THE SAME



CONTINUOUS ASH DISCHARGE BY THE HYDRAULIC SMOOTH-FLOW METHOD



IMPROVEMENTS Make the Difference in Æ Taylor Stokers, Too!

CONSTANT IMPROVEMENTS have kept the flexible, versatile Æ Taylor Stoker two jumps ahead of fluctuating fuel prices, shifts in coal availability and strides forward in power plant economy. Just one of the advanced engineering features that adds to its 40-year success story, is the smooth-flow hydraulic drive which brings new efficiency to continuous ash discharge.

The smooth action of powerful hydraulic cylinders has been harnessed to provide simple, direct operation of the overfeed sections of the stoker—moving ash all the way to the tip of the ash discharge plate, at a predetermined, uniform rate. Independence from the main stoker drive eliminates complex mechanisms and the need for frequent adjustment. You get positive ash discharge *continuously* as required by fluctuating steam requirements and the variable ash content of coals.

Find out more about this and other *improved* features of the Æ Taylor Stoker—how they can be adapted to consistently produce more steam at top efficiency in *your* plant. Write for Catalog R-A or ask for specific engineering assistance.

Other Æ Products: Æ-Perfect Spread Stoker, Lo-Hed Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power.

Æ

TAYLOR STOKER

AIR-COOLED & WATER-COOLED

The Only Underfeed Stoker with *all* these Features IN COMBINATION!

1. Continuous Self-Sealing Ash Disposal
2. Movable Ash Discharge Plates
3. Smooth-Flow Hydraulic Drive on Rear End
4. Independent Pusher Controls within ⅛ inch
5. Unique Sure-Feed Coal Agitators
6. Silent-Shift Spur Gear Planetary Power Transmission

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVE., PHILADELPHIA 25, PENNSYLVANIA

THE PACKING for EVERY PURPOSE

Stops Leaks Prevents Scoring

ALLPAX

This universal packing — consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphite scales and a heat-proof lubricant — is recommended for general service against steam, water, air, ammonia, oils, gases, etc. where temperatures do not exceed 600°F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

Distributors everywhere

THE ALLPAX CO., INC., MAMARONECK, N. Y.

CONTROL STEAM FLOW!

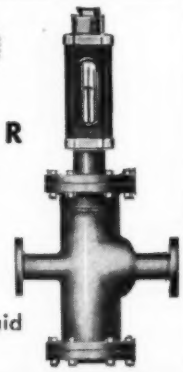
The Fischer and Porter Armored

VALVE BODY ROTAMETER

Can withstand pressures as high as ..... 2000 PSI.
Steam flow rates can be accurately and economically

INDICATED
RECORDED
CONTROLLED
TOTALIZED

as readily as the flow rates of any other fluid

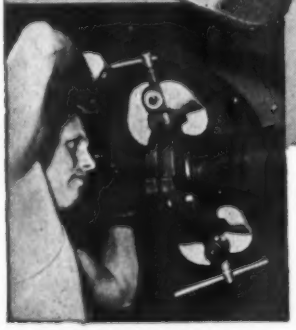


WRITE FOR CAT. **43E** — DEPT. 3-6G

FISCHER & PORTER COMPANY
HATBORO, PENNA.

FLANGE JACKS

...eliminate costly gasket replacement shut-downs!



An ingenious tool for opening pipe flanges for gasket renewal — quickly, easily and safely. FLANGE JACKS eliminate hazardous hammer and chisel methods and prevent damage to flange faces. Openings are smoothly made against great pressures, yet flanges are held in perfect alignment. FLANGE JACKS save time, reduce accidents . . . make better seals possible.

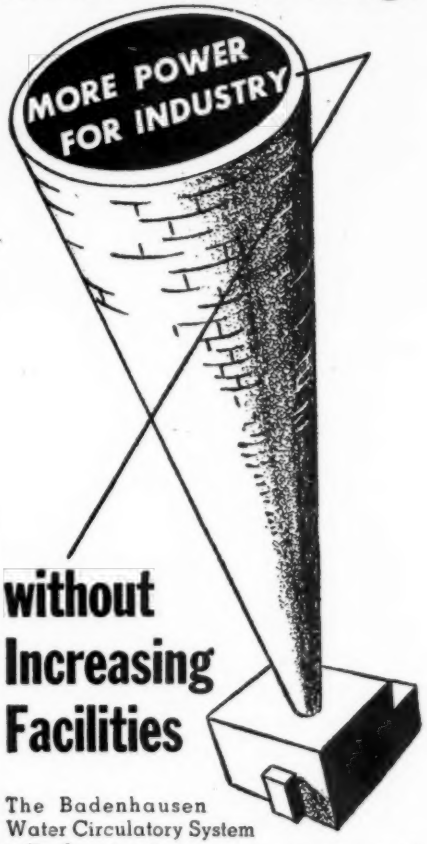
WRITE FOR LITERATURE
WRITE DEPT. E. FOR DETAILS OR SEE YOUR NEAREST DISTRIBUTOR.

MAXIMUM PROTECTION
to personnel and plant!

FLANGE JACKS are vital when replacing gaskets in presence of oil or gas fumes . . . eliminates hammer blows and sparks. FLANGE JACKS are a "must" in safety engineer specifications.

T. G. PERSSON COMPANY
224 GLENWOOD AVE., BLOOMFIELD, NEW JERSEY

43 Years Experience In Boiler and Power Plant Design



without Increasing Facilities

The Badenhausen Water Circulatory System will often increase steam capacity up to 100% — without the expense of new boilers, foundations, piping, or bunkers. It is not necessary to change the ash handling equipment, steam, water or other piping, breeching, stacks, draft fans, etc.

Protect your original investment, save the cost of a new installation, and at the same time—

1. Increase the use efficiency of your present equipment.
2. Increase steam capacity.
3. Reduce heavy maintenance costs.

by:
A. Integrating boiler design.
B. Reducing water entrainment.
C. Increasing fuel burning capacity.

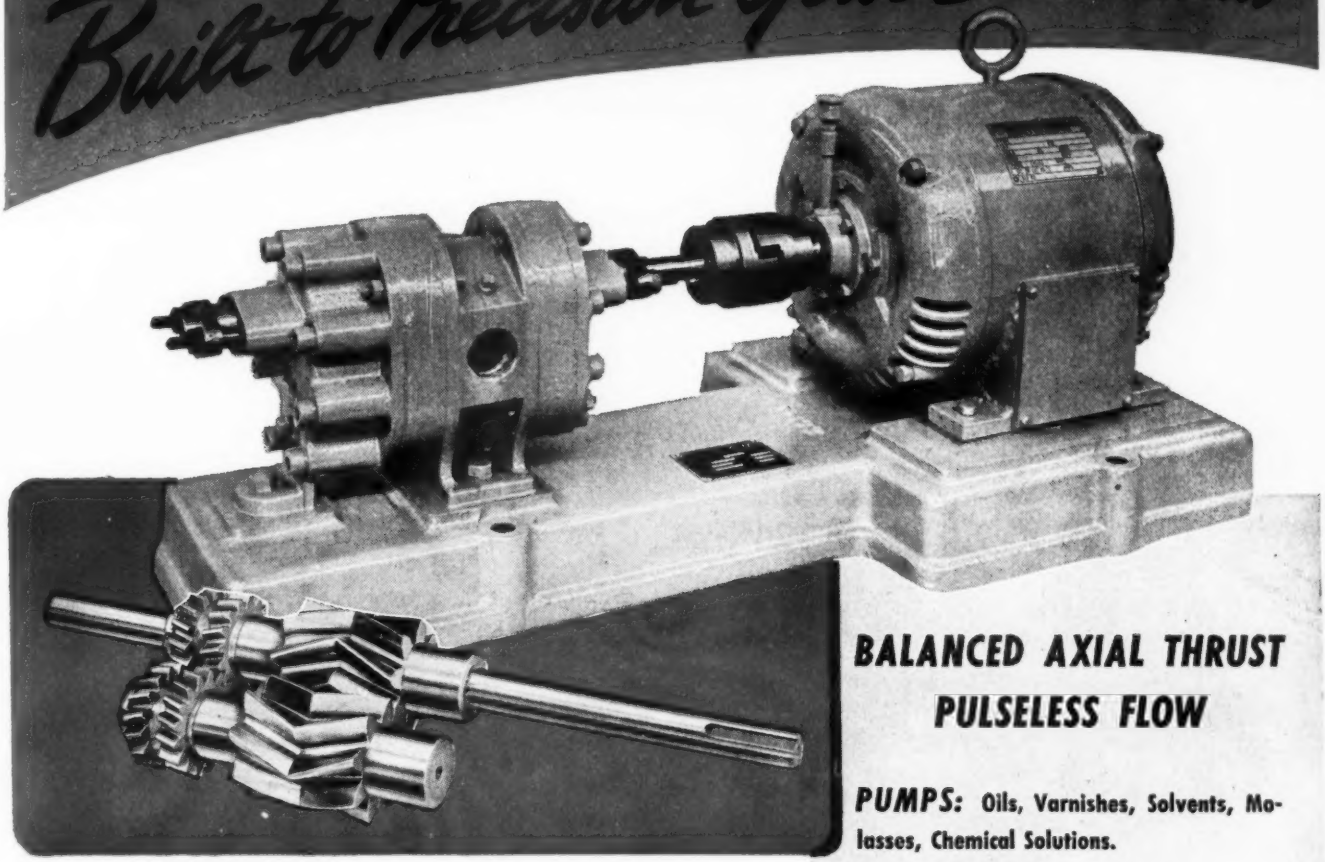
These very definite improvements and savings can and have been made by us without increasing load on boilers and without increasing draft loss.

The experience and knowledge of this engineering organization with 43 years in boiler and power plant design is your assurance of integrity in all matters. Your inquiries and immediate problems are welcome.

Write for Bulletin 115 on "Increased Steam Capacity."

JOHN PHILLIPS
BADENHAUSEN
INCORPORATED
18th Floor Packard Building,
Philadelphia 2, Pennsylvania
WATER WALLS • DUST ELIMINATION SYSTEMS • FIRING SYSTEMS
AUTOMATIC COAL FEEDER • SAWDUST AND OTHER WASTE MATERIALS
BURNED SUCCESSFULLY IN SUSPENSION MAINTAINING HIGH EFFICIENCY

NOW - ROTARY PUMPS
Built to Precision Gear Standards



BALANCED AXIAL THRUST
PULSELESS FLOW

PUMPS: **Oils, Varnishes, Solvents, Molasses, Chemical Solutions.**

CAPACITIES: **1 to 550 G. P. M.**

DISCHARGE: **250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.**

★

For Higher Pressures and Capacities Use

SIER-BATH SCREW PUMPS

The Sier-Bath GEAREX Runs Quieter, Lasts Longer Because of Minimum T.A.E.

● Why should longer life and quieter operation result from cutting the rotating parts of the Sier-Bath Gearex Pump to minimum T.A.E. (Total Accumulated Error)? Because this precision fabricating virtually eliminates timing gear impact loads and stress concentrations. It assures the maintenance of accurate rotor clearance. Thus, it helps maintain high efficiency throughout the Sier-Bath GEAREX Pump's long service life.

In other respects, too, this pump is unique. It provides a pulseless uninterrupted discharge and its rotors are *not in contact*. Deep-toothed, small in diameter, their low pitch line speeds result in efficient, quiet operation not found in the conventional type gear pumps. Their special design prevents trapping. Sier-Bath GEAREX Pumps are equipped with roller bushings for precision running under load.

They are available in horizontal and vertical models, internal and external bearing types, in steel or special alloys, and with jacketed bodies for high temperature applications or where heat must be applied. Write for detailed information.

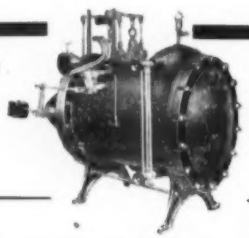
SIER-BATH GEAR COMPANY, INC.
9254 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

FOUNDED 1905 • MEMBER OF A. G. M. A.

Sier-Bath Gear Co. Inc.
PUMP DIVISION

(IT IS REASONABLE TO ASSUME)
THE COST OF
COAL
WILL CONTINUE TO
RISE

The STERLING SYSTEM will save you from 10 to 50% on the cost of fuel. A unique gravity system using 90% less steam than efficient pumps. Handles condensate above 212 degrees—eliminates the use of electricity entirely. Send us your steam problem!



AUTOMATIC!
POSITIVE!
EXCLUSIVE!
UNIQUE!

Sterling Engineering & Mfg. Corp.
(Templeton Mfg. Co.)
110 Business St.,
Hyde Park, 36, Massachusetts

Gives You
LONG, TROUBLE FREE SERVICE

Fig. 1635

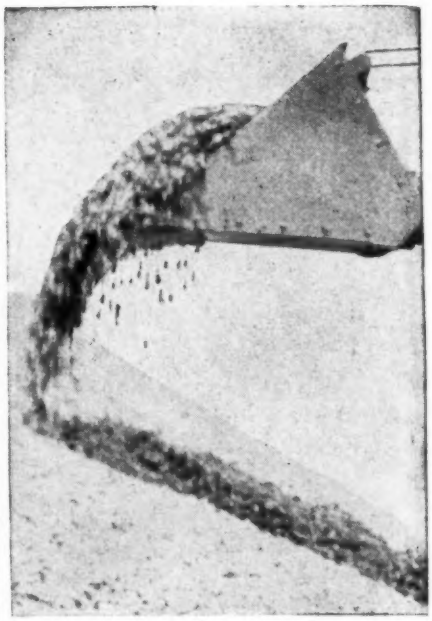
"STANDCO"
PILLOW BLOCKS

The attractive "Standco" Pillow Block shown above is sturdily built and is offered in a wide range of sizes. Babbitted and broached bearing surfaces, accurately machined faces. Can be amply lubricated.

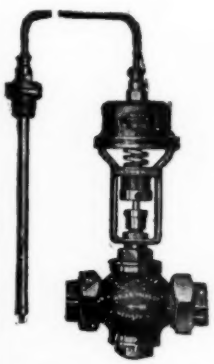
Write for Bulletin

"Unbrako" and "Hallowell" products are sold entirely through distributors.

Over 43 Years in Business
STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA., BOX 577
Boston • Chicago • Detroit • Indianapolis
St. Louis • San Francisco



How much of this good coal will be wasted?



10%?
25%?
50%?

Every reader knows that proper temperature regulation has much to do with the saving of fuel. Good sense tells you to make certain that only the exact amount of heat needed goes into your liquids in open or closed tanks, heaters, etc. Don't permit that valuable fuel to go to waste. Save it with

ATLAS
Temperature Regulators

The ATLAS Type 650, pictured, comes in sizes ½" to 2½". Easy to install and adjust. Both bulb and control valve will operate in vertical or horizontal position. Equipped with seamless metal bellows. Suitable for use with low or high pressure steam.

For data on other ATLAS Temperature Regulators see our ad in the Feb. 1945 issue of this journel, or better still, write for Bulletin 7A for complete information.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
289 South St. Newark 5, N. J.
Representatives in Principal Cities

WATER PROBLEMS
HAERING GLUCOSATES
over a period of years have controlled
CORROSION, SCALE, ALGAE
in Industrial Plants
Write on your letterhead for the latest "H-O-H Water Studies"
WE READ WATER

D. W. HAERING & CO., Inc.
GENERAL OFFICES:
205 West Wacker Drive, Chicago 6, Ill.

You Can Clean These Filters

WITHOUT TURNING A VALVE

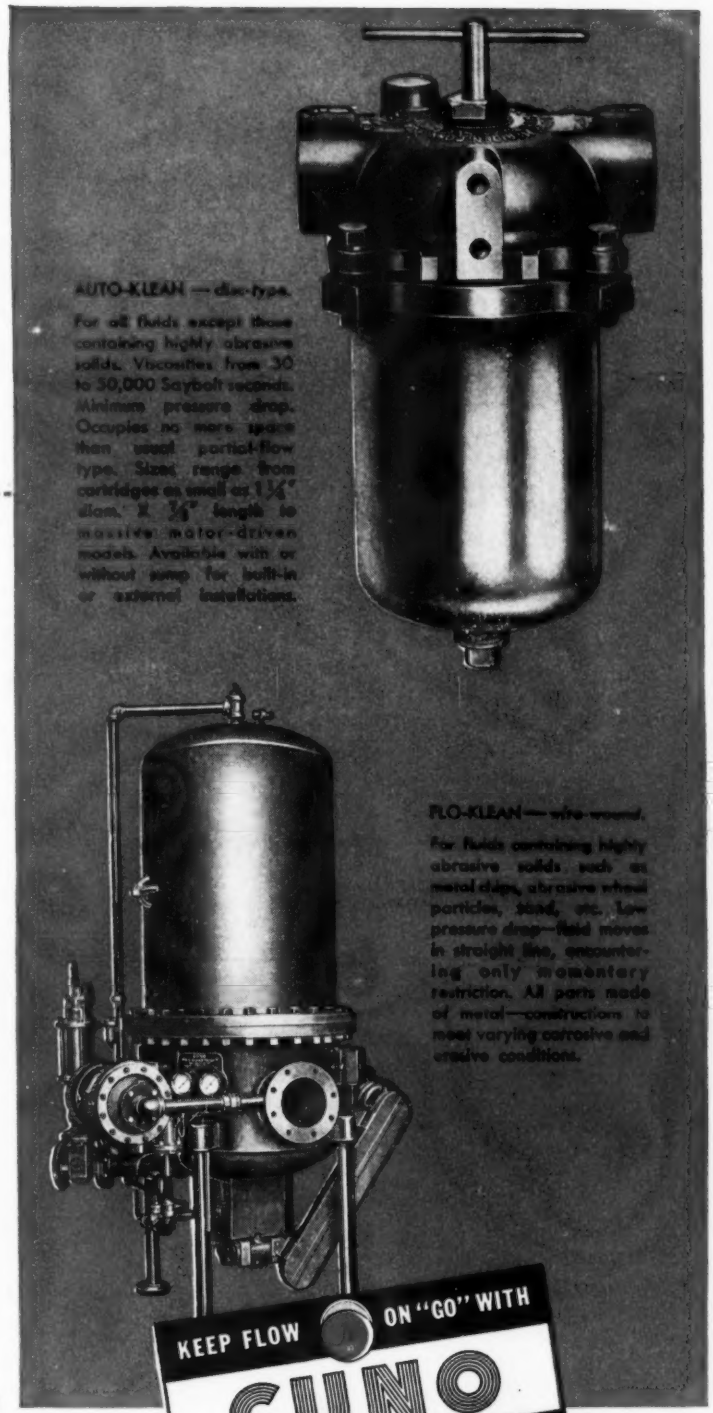
Flow never has to be stopped or diverted while a Cuno Filter is being cleaned. And you get this advantage without the expense — in space and investment — of a duplex installation.

Accumulated solids are removed . . . by turning a handle (with hand or motor) in the case of the Cuno Auto-Klean . . . by a motor-driven backwash system in the case of the Cuno Flo-Klean.

There is nothing, in either model, to remove or renew. The filter element is all-metal, non-collapsible. The only attention required is periodic emptying of the sump.

For positive cleaning action that is effective, as specified, down to .0025" particle size, specify Cuno. See Cuno catalog in SWEET'S for selection factors and specifications; or send coupon for complete Cuno catalog. Staff engineers are available for special recommendations.

For a Complete Cuno Catalog, send Coupon


AUTO-KLEAN — disc-type.
For all fluids except those containing highly abrasive solids. Viscosities from 30 to 30,000 Saybolt seconds. Minimum pressure drop. Occupies no more space than usual partial-flow type. Sizes range from cartridges as small as 1¼" diam. × ¾" length to massive motor-driven models. Available with or without pump for built-in or external installations.
FLO-KLEAN — wire-wound.
For fluids containing highly abrasive solids such as metal chips, abrasive wheel particles, sand, etc. Low pressure drop—fluid moves in straight line, encountering only momentary restriction. All parts made of metal—construction to meet varying corrosive and erosive conditions.
KEEP FLOW ON "GO" WITH
CUNO
ENGINEERED FILTRATION

CUNO ENGINEERING CORPORATION
2210 South Vine Street, Meriden, Conn.

Please send me a free copy of QUICK FACTS. I am especially interested in the services checked.

- ☐ Acids
- ☐ Air
- ☐ Alkali
- ☐ Boiler Feed
- ☐ Casein
- ☐ Cleaning Solutions
- ☐ Coatings
- ☐ Compressed Air
- ☐ Coolants
- ☐ Cutting Oils
- ☐ Dip Tank Systems
- ☐ Enamel
- ☐ Engine Fuel
- ☐ Engine Lubricating Oil
- ☐ Fuel Oil
- ☐ Fuel Tar
- ☐ Gases
- ☐ Gasoline
- ☐ Grease
- ☐ Grinder Coolant
- ☐ Hydraulic Oil
- ☐ Japan
- ☐ Lacquer
- ☐ Lubricating Oil
- ☐ Machine Tool Cutting Oil
- ☐ Machine Tool Hydraulic Oil
- ☐ Machine Tool Lubricating Oil
- ☐ Nitrocellulose Solutions
- ☐ Oils
- ☐ Paint
- ☐ Pyroxylin
- ☐ Quenching Oil
- ☐ Resins
- ☐ Rust Proofing Compounds
- ☐ Sizing
- ☐ Solvents
- ☐ Spray Systems
- ☐ Tar
- ☐ Test Stand Lubricating Oil
- ☐ Varnish
- ☐ Washing Compounds
- ☐ Water
- ☐ Wax

Name.....

Company.....

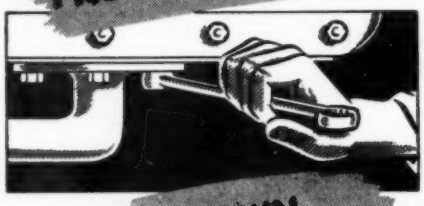
Address.....

Make Your Overhead Valves SAFE and Easy to Reach---

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

TASGON LOOSENS FROZEN PARTS...



CUTS DOWN MAINTENANCE TIME!

Tasgon, through its unique principle of colloidal penetration, gets into the tightest joints almost instantly. Dissolves gummed up oil, tar, paint . . . loosens frozen nuts, couplings, bushings . . . cleans, lubricates contact surfaces.

Tasgon's principle of colloidal penetration makes it the most efficient rust solvent on the market. Tasgon does the job fast, efficiently, and cheaply!

Send for free sample and complete information today.

Samuel Cabot, Inc.
1603 Oliver Building, Boston 9, Mass.

STEAM CONSUMPTION Before C-B Installation .... 2550 lbs. per hr. After.... 900 lbs. per hr.

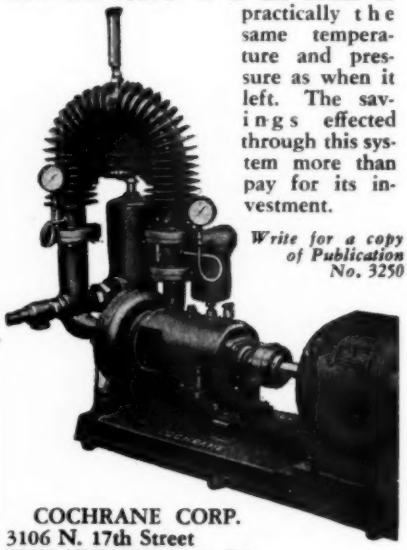
Recently, the Plastic Department of a large plant installed a flow meter to record and integrate the steam flow to this department only, so that accurate steam consumption records would be available. Then, it was felt desirable to improve upon the method of returning the condensate from the department so as to give better drainage of the equipment and thus improve operation and production.

The following tabulation indicates results obtained:

	Before C-B Installation	After C-B Installation
Steam Consumption	2550 lbs. per hr.	900 lbs. per hr.
Temp. Boiler Feedwater	220°F	245°F
Temp. Condensate		355-365°F
Flash Loss	approx. 330 lbs. per hr.	NONE

Results like these are typical in the more than 50 industries where the Cochrane C-B System is used. Increases in production go as high as 61%—fuel savings to 20%—time savings to 28%—lower labor costs to 22%.

The Cochrane C-B System of high pressure condensate return is a system that drains condensate from process equipment and returns it to the boiler at practically the same temperature and pressure as when it left. The savings effected through this system more than pay for its investment.



Write for a copy of Publication No. 3250

COCHRANE CORP.
3106 N. 17th Street
PHILADELPHIA 32, PA.

COCHRANE C-B SYSTEM
CONDENSATE RETURNED TO BOILERS AT HIGH PRESSURE AND HIGH TEMPERATURE

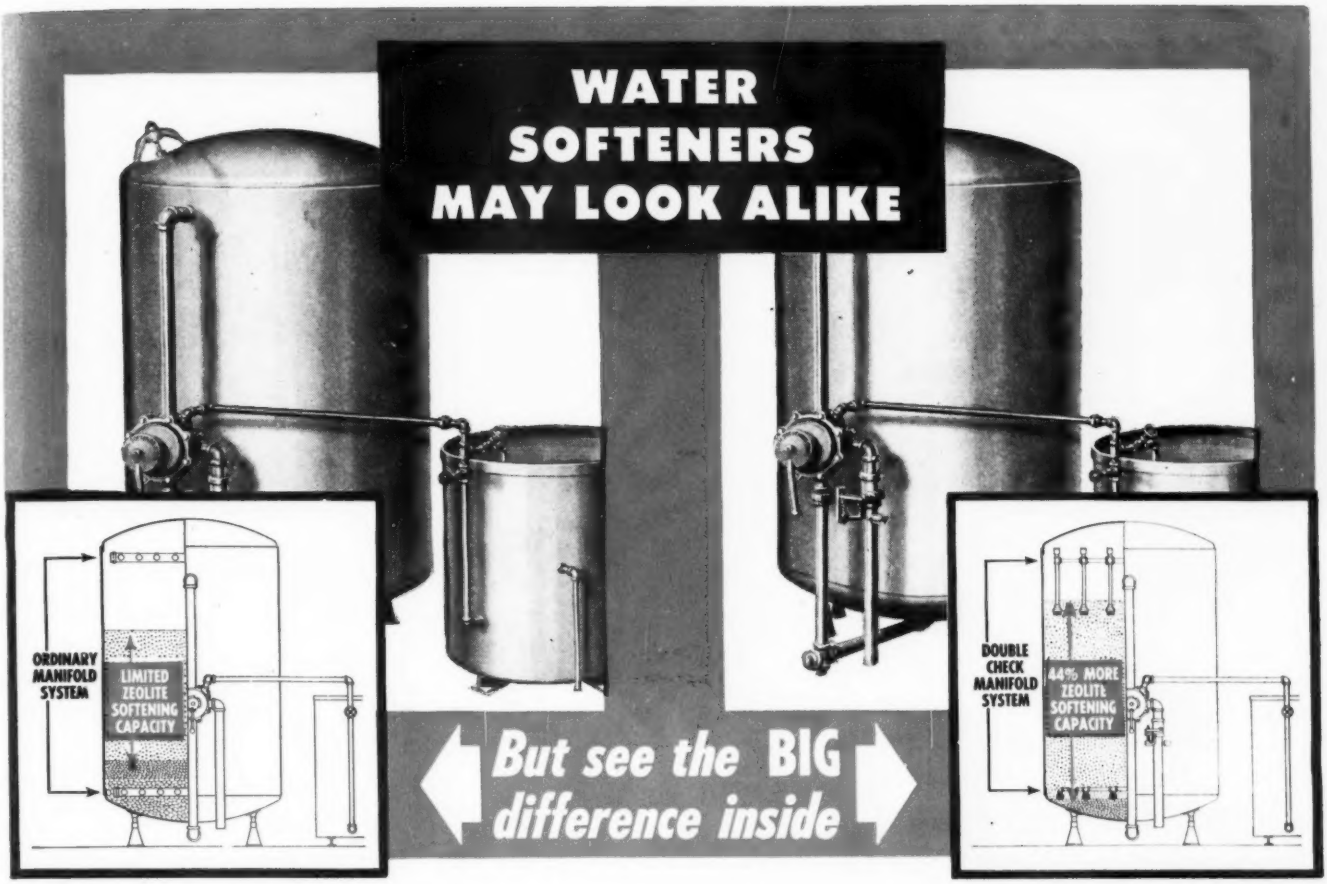
PRESSURE, TEMPERATURE, FLOW, ELECTRICAL AND LEVEL MEASURING INSTRUMENTS

UNITED STATES GAUGE

DIVISION OF AMERICAN MACHINE AND METALS, INC.
SELLERSVILLE, PENNSYLVANIA (15)

6 out of 10
manufacturers of original equipment specify U.S.G.

WATER SOFTENERS MAY LOOK ALIKE


ORDINARY MANIFOLD SYSTEM
LIMITED ZEOLITE SOFTENING CAPACITY
But see the BIG difference inside
DOUBLE CHECK MANIFOLD SYSTEM
44% MORE ZEOLITE SOFTENING CAPACITY

ORDINARY SOFTENER — **IMPROVED ELGIN SOFTENER**

It so happens that all water softeners are pretty much alike in outward appearance. But there the resemblance ends. Look inside the Elgin and you'll see an important difference — the new Elgin "Double-Check" manifold system.

The diagrams show how this increases capacity by permitting a deeper softening bed without loss of zeolite — a loss that ordinary softeners attempt to avoid by limiting the depth of the zeolite bed. Look further and you'll see how this improved manifold system brings many more unmatched softener features as listed at right.

Whatever your hard water problem, remember that in the final analysis, water softening capacity is what you buy. Examine all softeners in this light and you'll see why the new Elgin ranks as one of the great advances in water conditioning. New bulletin giving all the facts is yours for the asking.

No Other Softener Offers—

- Lower First Cost
- Lower Operating Cost
- Higher Efficiency
- Less Maintenance
- Longer Life
- Less Space Required

THE IMPROVED ELGIN GIVES 44% MORE SOFT WATER

Modernize your old softener

Using the ingenious "Double-Check" manifold arrangement, it is a simple matter to convert any water softener to Elgin design. When supplemented by high-capacity Elgin Zeolite this modernization provides up to 44% more soft water and reduces operating and maintenance costs. The cost is surprisingly low. New bulletin tells all about it.

Let your nearest Elgin Engineer help you plan

NEW BULLETIN 607 has all the facts. Write for your copy.

ELGIN SOFTENER CORPORATION

130 NORTH GROVE AVENUE, ELGIN, ILLINOIS

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

Economize WITH POWERS

TEMPERATURE REGULATORS

Use a Powers No. 11 Temperature Indicating Regulator when you want the advantages of an easy-to-read dial thermometer combined with a dependable self-operating regulator. The dial thermometer gives a visual check on the performance of the regulator and makes it easy to adjust for the required operating temperature. Various dials and ranges are available.

Is Easy To Install—because both the thermometer and the regulator operate from the same thermal system—only one tapped opening is required.

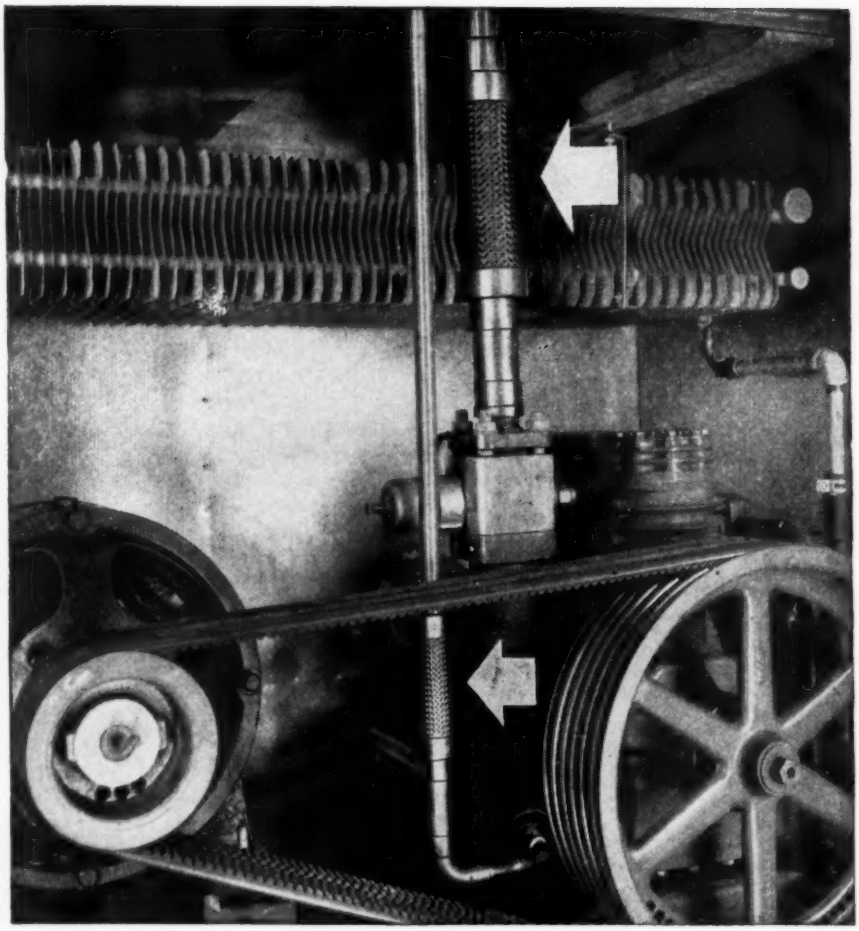
Write for Circular 2511

THE POWERS REGULATOR CO.

2717 Greenview Avenue, Chicago 14, Illinois
231 E. 46th St., New York 17, N. Y.—Offices In 47 Cities . . . See your phone directory.

70

OVER 50 YEARS
OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL



REX *Vibra-Sorbers*

Reduce Vibration Hazards

REX VIBRA-SORBERS—properly installed—substantially reduce servicing costs. For **REX VIBRA-SORBERS** have the exceptional strength and flexibility needed to absorb prolonged vibration and thus prevent the transmission of noises throughout the entire piping system.

In addition, **REX VIBRA-SORBERS** are pressure-tested to insure "refrigerant-tightness." This means greater protection against leakage of valuable refrigerants. **REX VIBRA-SORBERS** of copper bearing alloy are normally used for Freon and Menthol. Units of steel alloys are available for ammonia. Thus, effective corrosion resistance is assured in all types of installations.

Let experienced C.M.H. engineers help solve your vibration problems. Write today for full information.

Flexible Metal Hose for Every Industrial Use

ARMY E NAVY

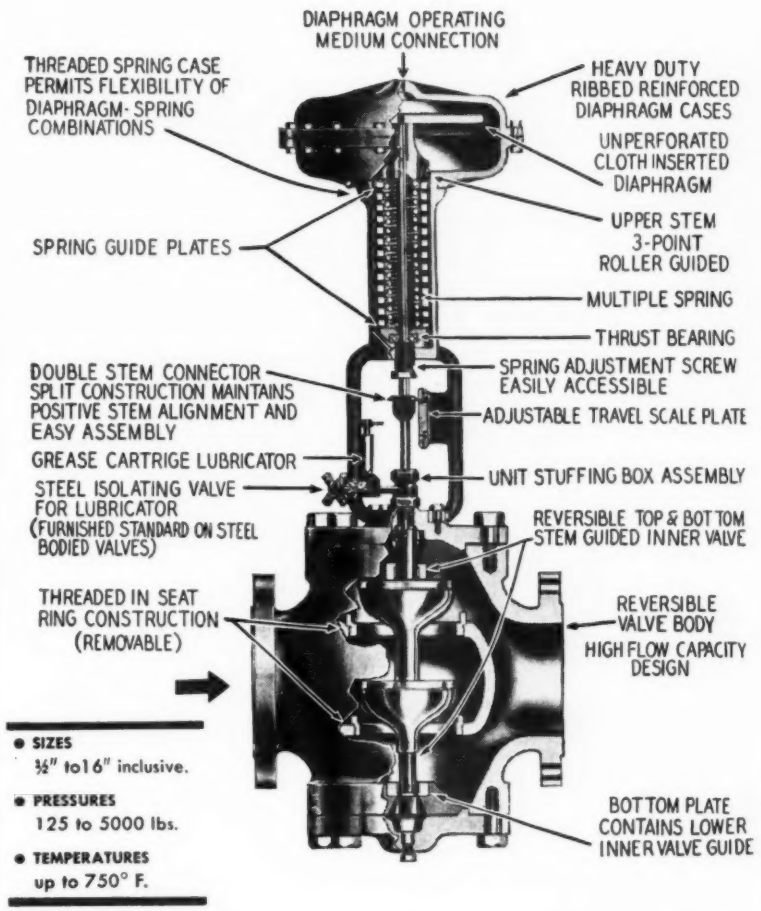
CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

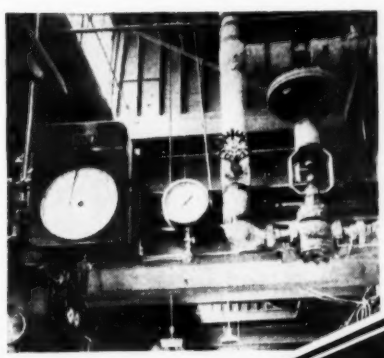
Design for *Better* PROCESS CONTROL

as exemplified in a *Superior*

MOTOR DIAPHRAGM VALVE


DIAPHRAGM OPERATING MEDIUM CONNECTION
THREADED SPRING CASE PERMITS FLEXIBILITY OF DIAPHRAGM-SPRING COMBINATIONS
HEAVY DUTY RIBBED REINFORCED DIAPHRAGM CASES
UNPERFORATED CLOTH INSERTED DIAPHRAGM
SPRING GUIDE PLATES
UPPER STEM 3-POINT ROLLER GUIDED
MULTIPLE SPRING
THRUST BEARING
DOUBLE STEM CONNECTOR SPLIT CONSTRUCTION MAINTAINS POSITIVE STEM ALIGNMENT AND EASY ASSEMBLY
SPRING ADJUSTMENT SCREW EASILY ACCESSIBLE
ADJUSTABLE TRAVEL SCALE PLATE
GREASE CARTRIGE LUBRICATOR
STEEL ISOLATING VALVE FOR LUBRICATOR (FURNISHED STANDARD ON STEEL BODIED VALVES)
UNIT STUFFING BOX ASSEMBLY
REVERSIBLE TOP & BOTTOM STEM GUIDED INNER VALVE
THREADED IN SEAT RING CONSTRUCTION (REMOVABLE)
REVERSIBLE VALVE BODY
HIGH FLOW CAPACITY DESIGN
BOTTOM PLATE CONTAINS LOWER INNER VALVE GUIDE

- **SIZES** ½" to 16" inclusive.
- **PRESSURES** 125 to 5000 lbs.
- **TEMPERATURES** up to 750° F.



THE NEW McALEAR TYPE H-86 MOTOR DIAPHRAGM VALVE, here shown, like other McAlear Automatic Controls, meets new and unusually critical requirements resulting from recent technological advancements in process industries.

In the processing of high octane gasoline, synthetic rubber, resins, plastics, chemicals, etc., wherever advanced new methods—employing abnormally high pressures and temperatures—call for controls of greater sturdiness and higher precision, McAlear Controls are maintaining continuous, uninterrupted production.

BRING YOUR CONTROL PROBLEMS TO McALEAR. Draw on the wide experience of McAlear engineers . . on their readiness and willingness to help you. For informative bulletins or catalog, write McAlear Manufacturing Company, Automatic Control Division of Climax Industries, 1913 S. Western Avenue, Chicago 8, Illinois.

CLIMAX INDUSTRIES

McALEAR

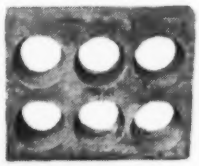
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE

controls

for STEAM, WATER, AIR, OIL and GAS

WHEN YOU NEED

A SPECIAL FIRE CLAY SHAPE . . .



Don't Wait 6 Weeks or Longer . . . use:

ADACAST

A low cost, castable refractory that pours like cement. So easy to use, unskilled plant labor can turn out fine finished results.

Illustrated: Burner Block made with Adacast. Shrinkage and expansion are minor, so that forms can be made actual size.

BOTFIELD REFRACTORIES CO.

784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

COMING IN THE DECEMBER ISSUE OF POWER

A Special Section on BOILERS and STEAM GENERATORS

Covering fundamental principles, construction details, types and applications, operation and maintenance. Enter your subscription now to get this 48-page handbook in the December issue.

This Armored Floor Never Wears Out!

Hendrick's Mitco Armorgrids add great strength and rigidity to floors, platforms, ramps and driveways subject to shock, grinding loads and continuous wear. Floors of cement, asphalt, mastic or other compositions never require replacement when reinforced with Mitco.

Mitco Armorgrids are completely fabricated units, requiring no bolts, rivets or assembly work—and unlike other floor armorings do not depend on fill for development of full strength. Write for Mitco Booklet today.

HENDRICK

Manufacturing Company

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and Amorgrids.

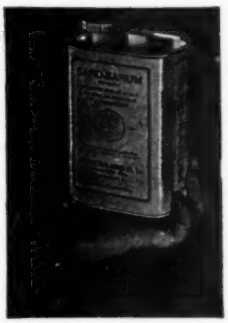
45 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

☆

"The Entirely Different Boiler and Engine Treatment"

SAND-BANUM



Brings you Simplicity Certainty and Economy in the operation of all types of low and high pressure boilers and stationary, locomotive and marine service.

ABSOLUTELY SAFE TO USE

Free of acids and other injuries ingredients—a pure vegetable compound.

NOT A SECRET PREPARATION

but a carefully prepared concentrate, protected by U. S. and foreign patents. It is the result of years of research into colloidal chemistry, as well as upon practical experience in diverse kinds of boiler equipment throughout the world. Sand-Banum has faithfully served industry for more than 20 years.

NO BULKY CONTAINERS

Sand-Banum comes in standard cans containing 16 fluid ounces—all active ingredients—(weighing 22 ounces avoidupois). 1 can is sufficient to treat a 250 H.P. boiler for 1 month.

EQUALLY EFFECTIVE

Water in various localities differs in content of scale-forming ingredients. Sand-Banum combines with scale-forming ingredients and treats boilers and tubes which are constant and fixed factors; equally effective in all territories at all times.

AUTOMATIC ACTION

Automatically, while your equipment operates, Sand-Banum gradually dissolves any accumulated scale formation, and prevents the formation of new; and—it does not carry over with the steam.

"SATISFACTION OR NO MONEY"

We will send you Sand-Banum for trial, charges prepaid, with the distinct understanding that if, at the end of 30, to 60 or 90 days, you are not satisfied with results, you owe us nothing—only a report. You lose nothing by becoming acquainted with Sand-Banum—You can gain much, for the elimination and prevention of scale and corrosion mean longer life, fuel economy and higher, sustained efficiency.

Send Your Trial Order Today!

AMERICAN SAND-BANUM COMPANY, Inc.

9 Rockefeller Plaza, New York 20, N. Y.

Stocks carried by
WESTERN SAND-BANUM COMPANY
Houston, Texas

and at other convenient points including leading supply houses

Export Representatives
PETROLEUM MACHINERY CORP.
30 Rockefeller Plaza New York 20, N. Y.

A Simplified SK Strainer . . .

designed to give you more for your money

Here is a duplex strainer which does a thorough job of removing dirt and other foreign matter from oil, water and other liquids, *yet is moderately priced.* Design simplifications, standardization and construction economies all contribute to making this new strainer outstanding in many ways.

Check These Features:

DUPLEX DESIGN—
permits each strainer to be cleaned without flow interruption.

ONLY 1 VALVE—
single shut off cock with double-port provides continuous flow during switch-over and is pressure balanced for easy operation. Steel spring takes up any plug wear and insures against leakage.

VERTICAL BASKETS—
allow continuous flow while cleaning. Dirt is collected in the basket which is easily removed without loss of fluid. Strainer free area is a minimum of 5 times pipe area.

SINGLE-SETSCREW CLAMPS—
quickly removable, yet seal basket chambers tightly.

PACKING GLANDS—
nut-and-stud type, easy to adjust and will not corrode and "freeze."

PLUG DRAINS—
on basket chambers for draining fluid from unit.

Made of cast bronze, these SK Duplex Strainers are designed for pressures up to 125 psi, in pipe sizes from ½ to 2 inches. Being light-weight, they need no support other than the pipe line.

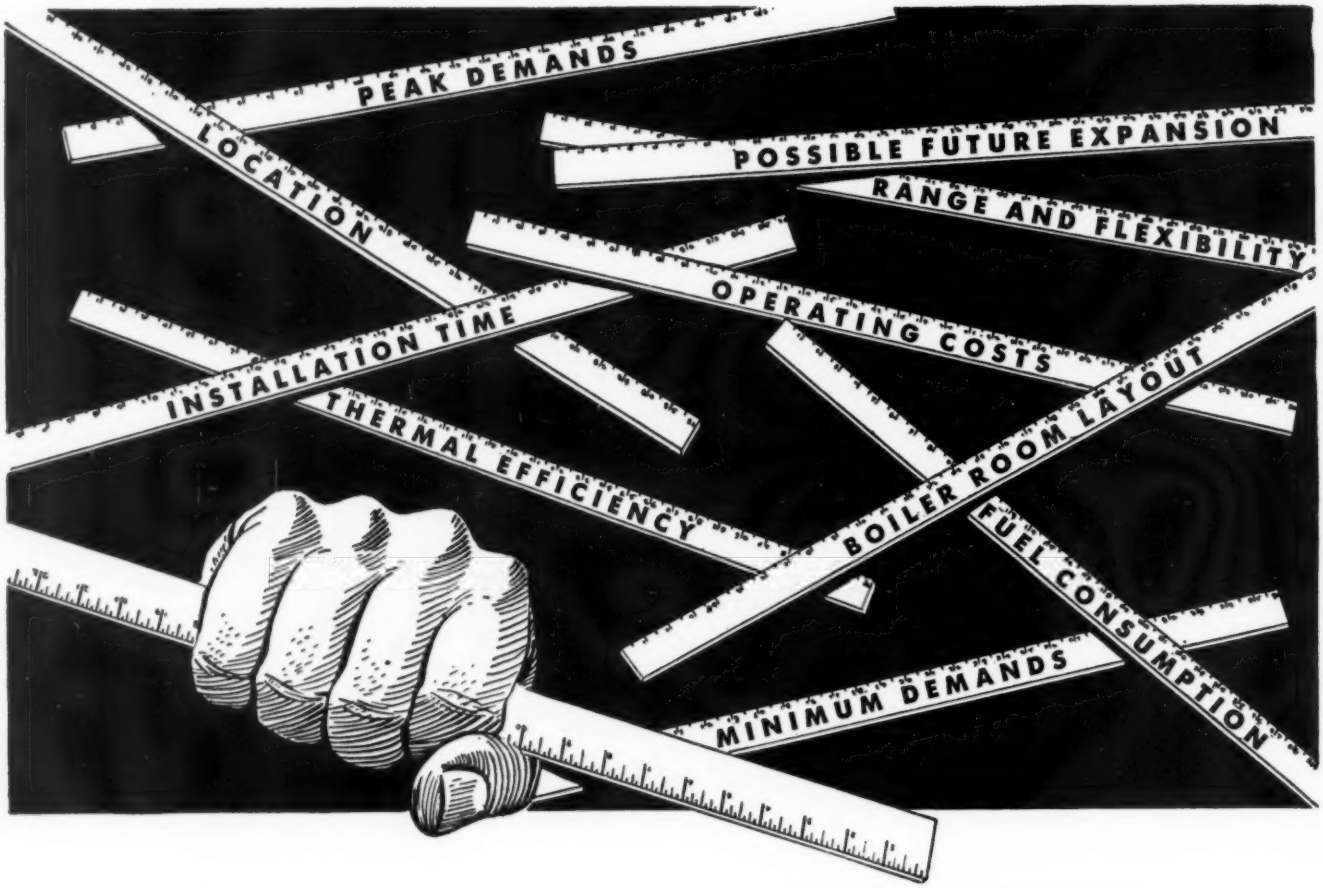
Other SK Strainers are made in cast iron for pressures up to 250 psi or steel for pressures up to 600 psi and sizes up to 6 inches.

JET APPARATUS • CONDENSERS AND VACUUM PUMPS • HEAT TRANSFER EQUIPMENT
VALVES • ROTAMETERS • FLOW INDICATORS • GEAR PUMPS • STRAINERS
OIL BURNING EQUIPMENT • SPRAY NOZZLES AND ATOMIZERS • RADIAFIN TUBES

SCHUTTE & KOERTING CO.

Manufacturing Engineers

1150 Thompson Street, Philadelphia 22, Pa.



WE USE A LOT OF YARDSTICKS

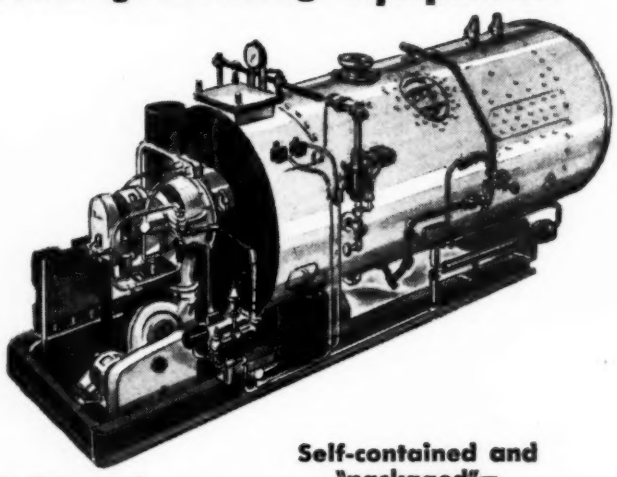
to help you select the proper steam generating equipment!

Fuel and steam costs are usually major items in production and plant operation. That's why it pays to have a steam plant designed to meet your steam loads most efficiently.

Cleaver-Brooks does not sell you a steam generator "off the shelf." Your steam requirements on the basis of present loads and future growth are first analyzed by a Cleaver-Brooks engineer and recommendations are then made for your specific needs.

With sound application engineering of this kind plus basically sound steam plant design and construction, the maximum of lasting value is provided by your Cleaver-Brooks steam generator from the day it is installed. *Write for bulletin and complete information.*

CLEAVER-BROOKS COMPANY, 332 E. Keefe Ave., **Milwaukee, 12, Wis.**



Self-contained and "packaged"—

Delivery consists of a "packaged" unit. Connections to service outlets are all that is needed. No smokestack is used — a simple vent carries away all products of combustion. No extra foundation is required. Compact — the unit fits into limited space and low headroom locations. Sizes: 22 models — 15 to 500 hp; pressures 15 to 200 lbs. p.s.i.

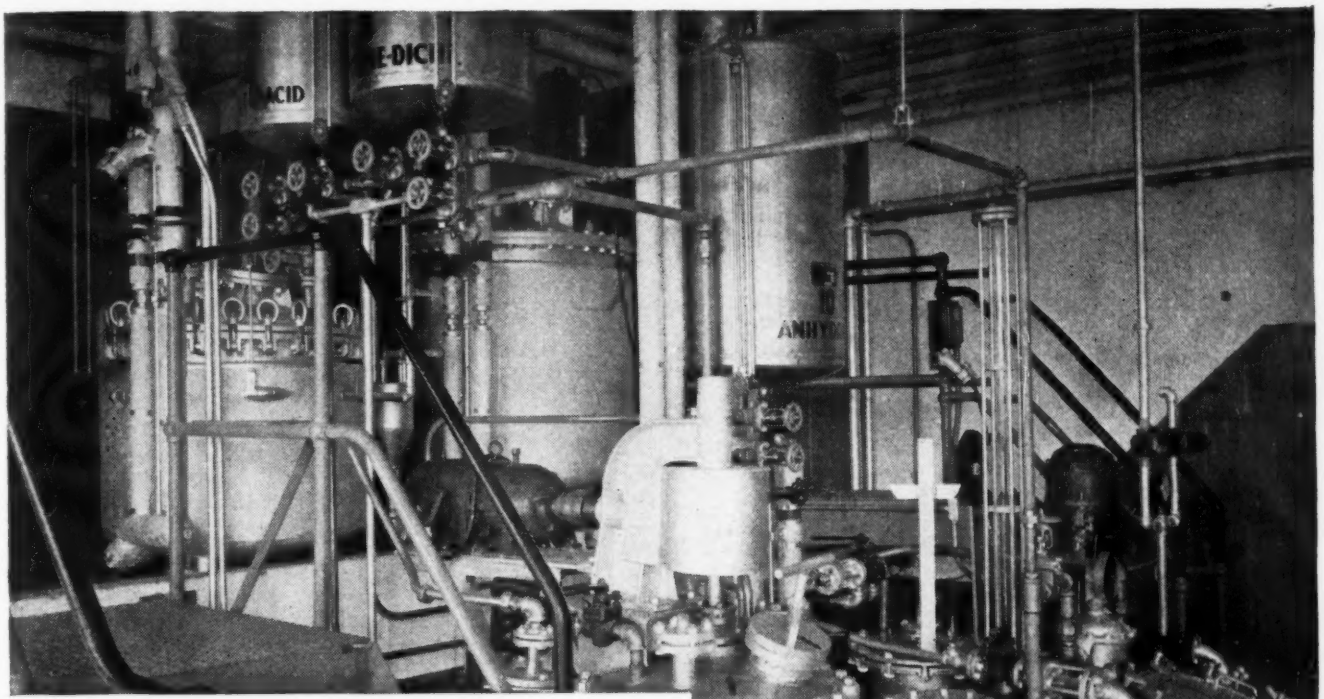
Money-making performance—

The Cleaver-Brooks Steam Generator is designed for easy operation and low upkeep cost. Operation is at 80% efficiency from full load down to 30% of its rating. The high heat transfer from the 4-pass, down-draft boiler produces fast steaming. A boiler room as clean as the home or office is possible through use of oil for fuel.

WRITE on your business letterhead for the Free Steam Cost-Calculator — a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

Cleaver-Brooks
STEAM
GENERATORS

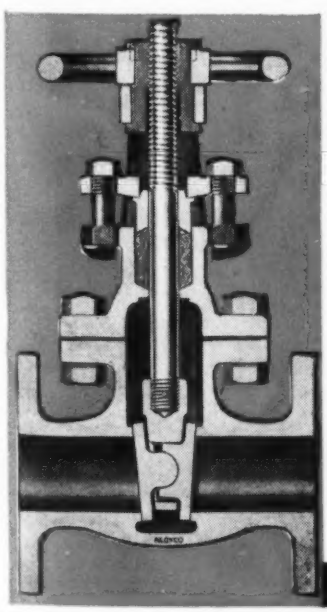
NO CONTAMINATION HERE



Because CIBA *Uses* ALOYCO STAINLESS STEEL VALVES

HORMONE and vitamin concentrates are precious! Batches, often worth $5,000, must be protected against metallic contamination. Delicate processes must not be upset by valve failures. So Ciba Pharmaceutical Products, Inc., Summit, N. J., specifies Aloyco Stainless Steel Valves.

These valves are contamination-proof because they are made entirely of alloy. The uniform corrosion-resistance of these alloys is assured by carefully controlled analyses. To provide easy, positive action, Aloyco Valves are accurately machined with super-finished seating surfaces. In addition, they are designed for quick disassembly—a necessity where valves must be inspected, cleaned, and sterilized; as in beverage, food and pharmaceutical plants. Long in service life, Aloyco Valves well merit what W. Bluntschli, Chief Engineer of Ciba, says of them, "We have found that the maintenance of these valves, and we have hundreds of them in different sizes in the departments mentioned, is practically nil under the corrosive mixtures of chemicals and solvents they handle."



ALOYCO DOUBLE DISC WEDGE Provides Positive Closure That Protects Ciba's Processes

Discs are free to rotate, non-fouling in any position. The flexibility of this design assures pressure tightness on both seats and affords easy repairs in user's own shop.

ALOYCO

STAINLESS STEEL VALVES AND FITTINGS

GATE, GLOBE, Y, CHECK, TANK, SAMPLING AND V-PORT VALVES
SCREWED, FLANGED AND WELDED FITTINGS

ALLOY STEEL PRODUCTS COMPANY, INC.

1403 WEST ELIZABETH AVE. • LINDEN, N. J.

on the spot

BENDING

COLD QUICK ACCURATE

with the W-S Portable Pipe Bender

THE Watson-Stillman Portable Hydraulic Pipe Bender will bend pipe or tubing up to 3 inches cold and right on the spot where it is needed.

Its open jaw construction permits the pipe to be inserted without removing bending dies or former. The work is in full view during the bending operation and the degree of bend can be checked at any point without removing pipe from the bender.

The bender is ruggedly constructed of forged steel and the pump cylinder is made from seamless steel tube. It will bend all standard, extra strong and double extra strong steel pipe from ⅜" to 2" as well as standard weight pipe in 2½" and 3" sizes. Bending dies are supplied for each size of pipe.

WATSON-STILLMAN COMPANY
Distributor Products Division
ROSELLE, NEW JERSEY
Sold only through distributors

WATSON-STILLMAN
DISTRIBUTOR PRODUCTS DIVISION

1025

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

SINCE 1845

Local delivery of LAMPS all types . . . all sizes!

Every commercial shape and size of G-E lamp—incandescent or fluorescent—for indoor or outdoor fixtures—are distributed by Graybar. Clear lamps. Frosted lamps. Colored lamps. Germicidal lamps. Glow lamps. Heat lamps. Flashlight lamps. Yes, and every other specialized type—including the new Circline and Slimline fluorescents.

Faster Delivery from Local Stocks

Graybar maintains lamp stocks at warehouses strategically located in over 90 principal cities throughout the nation. Although all the lamps you want may not be immediately available, your surest way to obtain them as fast as possible is via Graybar.

Expert Advice on Lighting

Whatever your lighting requirements, Graybar can impartially recommend the exact lighting equipment for your particular needs from the most complete selection of lamps and lighting units available from any one source.

Our nearest branch office will welcome an opportunity to demonstrate the advantages of Graybar lighting service to you. *Graybar Electric Company, Graybar Building, New York 17, N. Y.* 4668

TO USERS OF LAMPS IN BIG QUANTITIES:

Ask us about a Graybar Lamp Contract, which can relieve you of all lamp-buying details and give you attractive cash savings.

IN OVER 90 PRINCIPAL CITIES

Everything Electrical via GraybaR

A Little Water is a *Dangerous* thing

Remove It— with a DE LAVAL

IN the lubricating system of a turbine or a Diesel engine, water can be a serious trouble-maker. It is every bit as necessary to remove moisture as it is to keep the lubricating oil free of dirt.

De Laval Oil Purifiers accomplish this dual function perfectly. By means of centrifugal force, they continuously discharge from dirty oil not only any solid impurities that may be present, such as rust, scale or dirt, but also any condensate or other moisture—whether only a few drops or several quarts per reservoir of oil.

Water in turbine oil leads to sludge, and sludge to serious deterioration of the oil. Water in Diesel oil forms an emulsion with the oil which may eventually lead to practically no lubrication at all. This is of especial importance on installations where the new heavy types of Diesel lubricating oil are used.

In short, De Laval Oil Purifiers are trouble-preventers. They afford more reliable protection to power units because their action is continuous, efficient and economical.

Write for additional details. Mention what type of power unit you have.

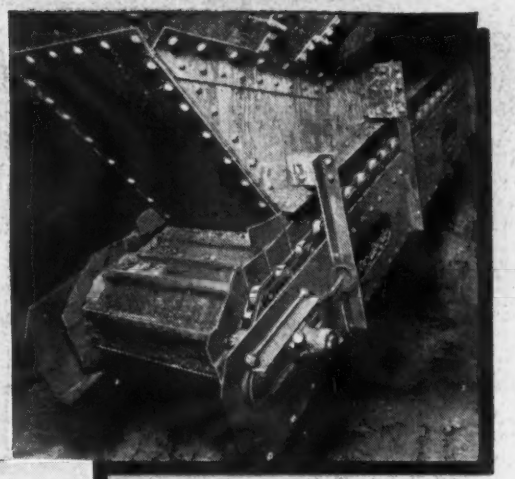
De Laval

LUBRICATING OIL PURIFIERS

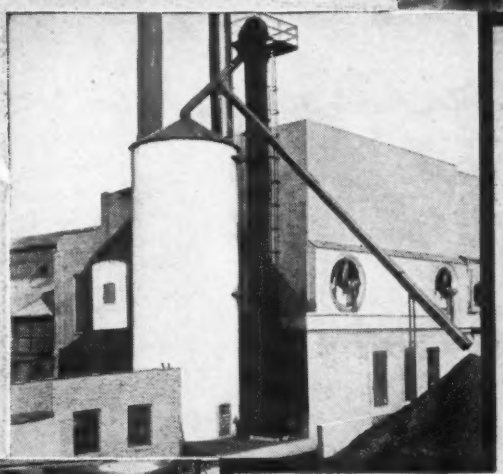
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

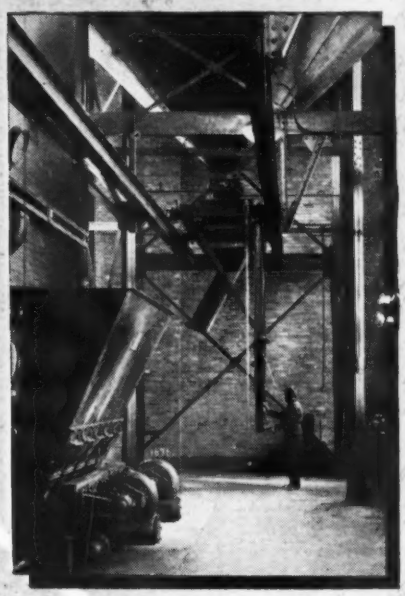
FOR LOW COST PER TON HANDLED

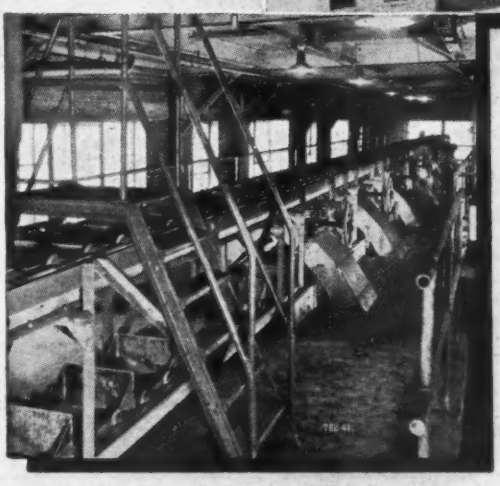
Use Jeffrey



Belt Idlers
Bin Valves
Bucket Elevators
Car Pullers
Chutes
Coal Crushers
Conveyors—Belt, Spiral, Pivoted Bucket, V Bucket, Chain, Scraper
Feeders—Apron, Electric Vibrating, Plate
Skip Hoists
Silo Storage Systems
Track Hoppers
Weigh Larries







Power Plant Equipment

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

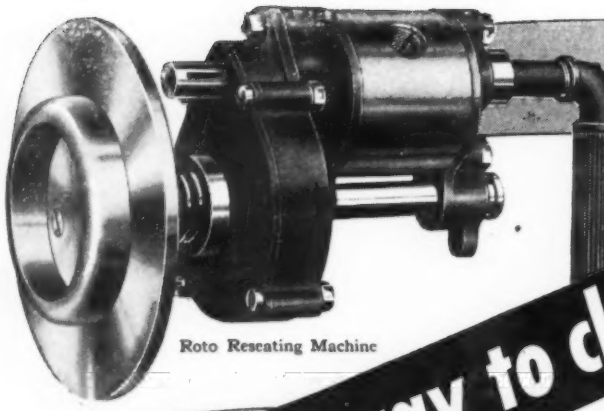
932-99 North Fourth St., Columbus 16, Ohio

Baltimore 1 Buffalo 2 Cleveland 15 Huntington 11 Milwaukee 11 Pittsburgh 22
Birmingham 3 Chicago 1 Denver 2 Houston 5 New York 7 St. Louis 2
Boston 16 Cincinnati 2 Detroit 32 Huntington 19 Philadelphia 3 Scranton 3 Salt Lake City 1

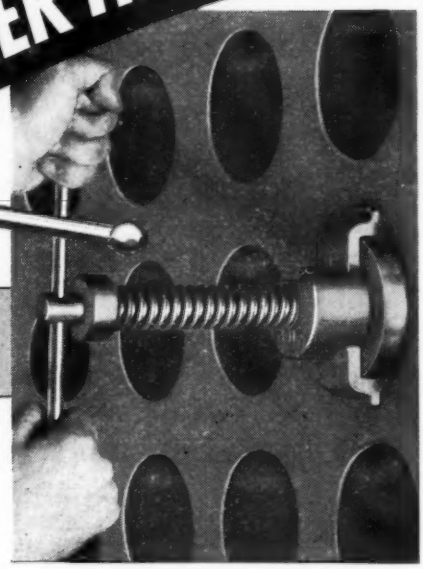
A quick way to clean BOILER HEADERS

with outside caps

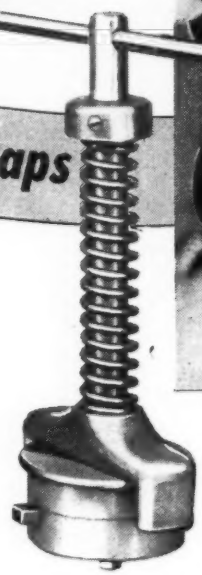
with inside caps



Roto Reseating Machine



Illustrating ease of operation of Roto Hand-hole Seat Scraper.



Roto Hand-hole Seat Scraper for Heine Boiler Headers

Roto offers you a quick, easy means of assuring tight, leak-proof joints between boiler headers and caps. The Roto Reseating Machine removes scale, rust or other adhering matter from headers with outside caps and provides a smooth, true fit.

For boiler headers with inside caps Roto offers a simple hand-hole seat scraper which cleans either round or oval holes. These machines have been used widely for many years, and are sold on a money-back guarantee of satisfaction.

ROTO RESEATING MACHINE

This air-driven machine cleans headers and caps with an abrasive cloth disk fastened to a flat surface plate whose pilot ring accurately centers the disk on the gasket seat. Caps are cleaned by fastening the machine in a vise and holding the cap against the disk. Three pilot rings are furnished, one for the header and two for cleaning both sides of the caps.

The inexpensive abrasive disk is easily replaceable when worn, assuring a true grinding surface at all times. The machine is light (10 lbs) and convenient to handle. It develops 1 hp at 5,000 rpm, and is geared down 5 to 1 to provide ample torque. Send for details and prices.

NOTE—This machine can also be used for cleaning ½" to 1½" condenser tubes by simply removing the surface plate and attaching Roto Extension Shafting with a fluted drill or wire brush.

ROTO HAND-HOLE SEAT SCRAPER

This simple, hand-operated tool consists of a cutting head with retractable cutters, mounted on the end of a revolving spindle having a bearing in a substantial yoke. An adjustable spring automatically maintains tension on the cutters, sufficient to remove all foreign matter but not enough to cut the metal. A few turns to the right and the job is done. A half turn to the left releases the machine.

Roto Scrapers are available for standard round or oval holes. Minor adjustments make them suitable for special sizes or conditions. Write for details and prices.

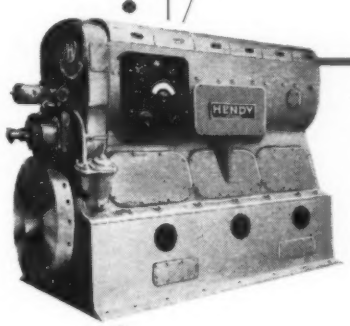
Make of Boiler	Tube Size	Opening
Babcock & Wilcox	4"	Oval
Babcock & Wilcox No. 40 Header	3¼"	Oval
Babcock & Wilcox No. 41 Header	2"	Oval
Babcock & Wilcox Superheater	2"	Round
Edge Moor	4"	Oval
Heine	3½"	Round
Keeler	4"	Round

ROTO Division of ELLIOTT COMPANY

153 SUSSEX AVENUE - - - NEWARK 1, N. J.

make your first investment in diesel power...

3 cents



A three-cent stamp will bring you important information about the latest in Diesel design... the new Hendy. New because it incorporates important features born of wartime necessity... plus scores of improvements suggested by owners, engineers, operators and maintenance men in an exhaustive survey of the Diesel field.

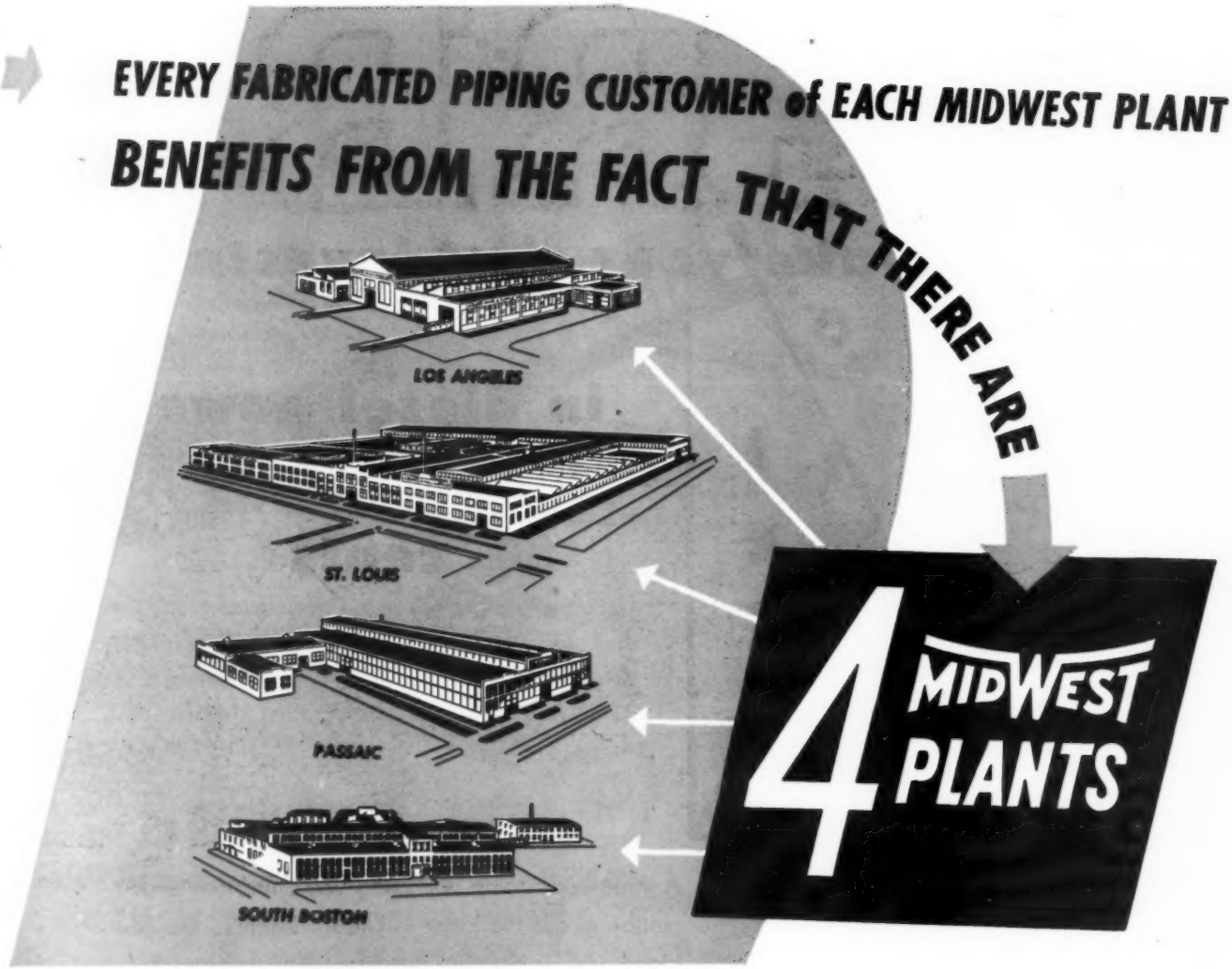
Write today for literature describing the new Hendy Diesels and Diesel-generator sets... 127 to 780 hp... with generators from 75 to 500 kw. You can afford to compare... you can't afford not to.

Power by Hendy

Joshua Hendy Iron Works • Est. 1856

Plants: **Sunnyvale and Torrance, California.**
Crocker-Wheeler Electric Division: Ampere, New Jersey.
Branch Offices: **Boston, Buffalo, Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Washington.**

EVERY FABRICATED PIPING CUSTOMER of EACH MIDWEST PLANT BENEFITS FROM THE FACT THAT THERE ARE



Strategically located in various parts of the country, all of the four Midwest plants are of definite benefit to every Midwest customer.

Undoubtedly the most important advantage is the better piping that results from the continuous exchange of information and experience between the four plants. For example, if Passaic develops a new and valuable technique or method, the information is made available at once to St. Louis, Los Angeles, and South Boston. When Los Angeles finds a better way to control grain size in forged lap joints, the other plants are immediately informed. Regardless of which plant fabricates your piping, you get the benefit of the combined experience of all four plants.

Other advantages are greater flexibility in meeting delivery requirements . . . a better understanding of regional conditions . . . source of supply close to the job.

Midwest is logically your first source of piping—whether you want a simple bend, a welded header, or a complete and complex piping job for a large plant fabricated and erected with undivided responsibility.

MIDWEST PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles • Subsidiary: Lumsden & Van Stone Co., South Boston 27, Mass. • Sales Offices: New York 7—30 Church St. • Chicago 3—643 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St.

4 PLANTS ARE BETTER THAN 1

PIPING FABRICATORS AND CONTRACTORS

TERRY

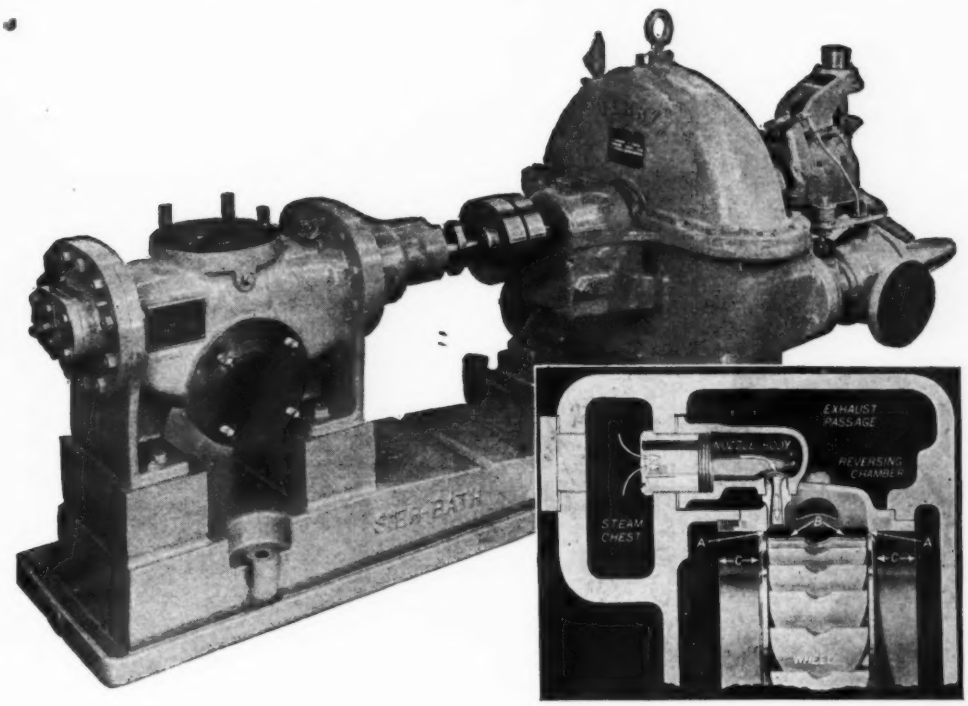


DIAGRAM SHOWING WHEEL CLEARANCES

AA — Rim clearance, B — Large blade clearance, CC — Side clearance, (about one inch). Blades cannot foul, as they are protected by rims. Rubbing at AA will do no damage. Side clearance is so large that end-play from excessive external thrust cannot damage wheel.

AMPLE WHEEL CLEARANCES IN THE TERRY WHEEL TURBINE INCREASE DEPENDABILITY

In the Terry Solid Wheel Turbine the buckets have large radial and axial clearance. They are further protected by projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced.

It is, therefore, impossible for the blades to foul. As the side clearance is very large (one inch), end play can do no damage.

Such construction makes for dependable operation.

The Terry Wheel Turbine is described in our Bulletin S-116. A request on your business letterhead will bring a copy.

Above: Typical Terry Wheel Turbine direct connected to Fuel Oil Pump. Unit is rated 24 H.P. at 1200 R.P.M.

T-1163

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

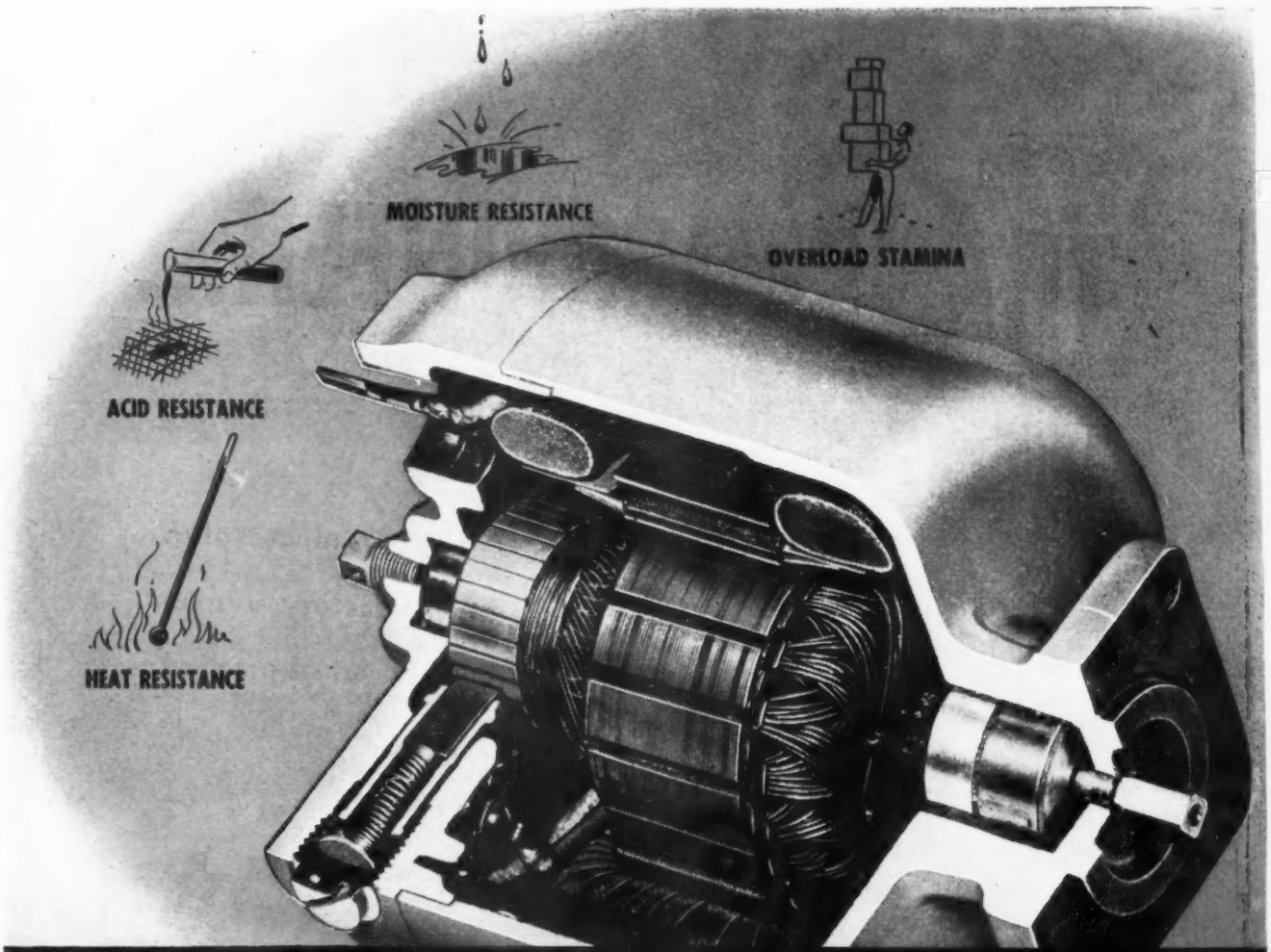
EXIDES HAVE THE EXTRA POWER DIESEL CRANKING DEMANDS

These powerful, ruggedly built Exides are designed specifically for this toughest of cranking jobs. They are a development of years of close identification with Diesel engineering progress, with which they have kept pace. For dependability, long-life and ease of maintenance, give your Diesel cranking job to Exides.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

Exide
BATTERIES



How much is "*High-Safety-Factor*" insulation worth to you?

It's worth plenty, if efficient, dependable operation of electrical equipment is important to your business—if moisture, oil, heat, overload, corrosive acids and vapors and human carelessness or inexperience represent hazards that can throw expensive machinery out of service or cause costly delays.

Fortunately, the cost of added protection against the penalties frequently imposed by these conditions is slight—far less than the penalty imposed by failures that can be avoided. For the advantages of High-Safety-Factor Insulation can be added at only a small fraction of the cost of the equipment.

That's why the swing is to Fiberglas Electrical Insulation Materials —why so many engineers, production executives and maintenance men are insisting on Fiberglas Insulation for the equipment they buy and for their maintenance work.

Get complete information about this better electrical insulation material—write for your copy of the folder "Are your motors a good insurance risk?" The names of the Distributors serving your locality will also be furnished, if you desire. Owens-Corning Fiberglas Corporation, Department 2000, Toledo 1, Ohio. Branches in principal cities.

In Canada: Fiberglas Canada Ltd., Toronto, Ontario

ASK FOR FIBERGLAS IN YOUR NEW MOTORS—AND ON YOUR NEXT REWINDS

OWENS-CORNING

FIBERGLAS

T.M. REG. U.S. PAT. OFF.

Fiberglas is the trade name for these electrical insulation materials and many other products made from fine, strong, pliable, moisture and heat-resistant, ageless glass fibers.

TRANSMISSIONEER...

WHO'S HE?

He's a graduate of a Dodge factory course, qualified by intensive training and a broad practical experience to give you the latest answers to problems in efficient mechanical transmission of power—in your plant or as applied to your product.

The Transmissioneer is backed by a broad line of Dodge bearings, sheaves, pulleys, clutches and other drive components. He is qualified by training and experience to select elements which make *the right drive for the job.*

Typical of the engineering advancement which marks Dodge products is the new Taperlock sheave, which has the simplest, surest mechanism ever devised for fastening wheels to shafts. For information about Taperlock—and other new developments in the mechanical transmission of power, call the Transmissioneer — your local Dodge distributor. Most power drive requirements can be supplied direct from the distributor's stock.

Look in the classified telephone directory under "Power Transmission Equipment" for your Transmissioneer's name and number. Call him for advice—without obligation.

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

To obtain his diploma every Transmissioneer must pass an intensive course of training at the Dodge factory. Lectures, classroom work and practical demonstrations of power transmission problems make up the course.

DODGE
MISHAWAKA

THE SYMBOL THAT CAME TO LIFE

257 factory graduate Transmissioneers wear this sign of a nation-wide personal service that helps you put all your power into the job.

Copyright, 1946, Dodge Mfg. Corp.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

IF YOUR STEAM CONSUMPTION IS THIS HIGH

WILL YOUR BOILER TUBE SCALE BE THIS LOW?

*Amberlite Softened Water ends boiler scale problems

Less than 1 pound of boiler scale formed by 1,000,000 pounds of steam! That's cutting down boiler scale to a minimum—an advantage you can obtain through the use of the AMBERLITE softening treatment.

With the AMBERLITE softening treatment, enormous volumes of softened water for boiler feed and cooling can be produced quickly and easily. Regardless of supply or seasonal fluctuations in quality, you can eliminate scale-forming impurities, reduce alkalinity, cut blow-down losses . . . tailor-make your water supply to the desired specifications.

Additional advantage of the AMBERLITE Ion Exchange resins for water softening are:

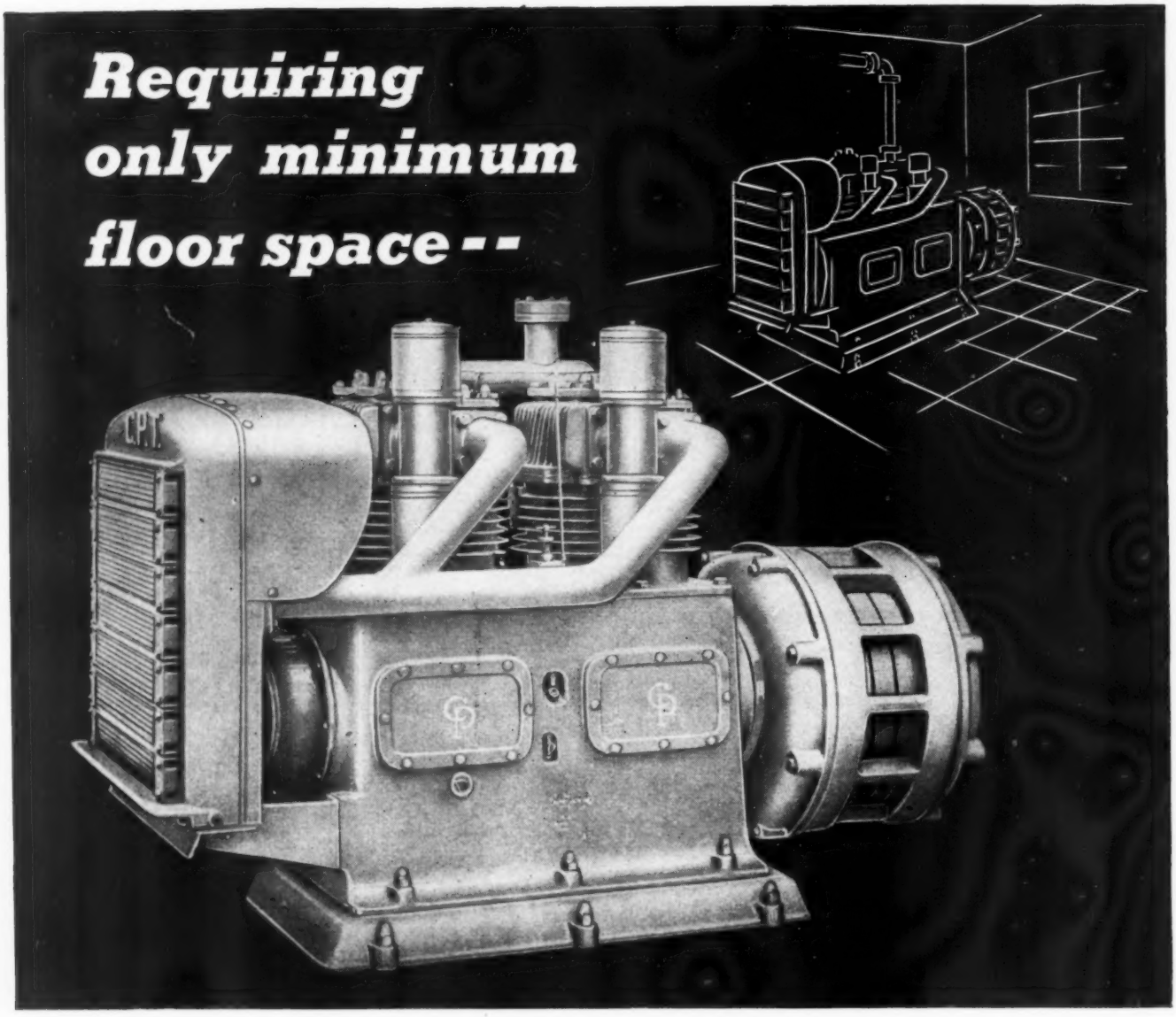
- Complete softening
- Minimum maintenance requirements
- Small space requirements
- Simplicity and flexibility of operation
- High throughput
- Uniformity of treated water supply

For complete information regarding the use of AMBERLITE Ion Exchange resins in your power plant, consult our technical staff.

AMBERLITE *is a trade-mark, Reg. U. S. Pat. Off.*

THE RESINOUS PRODUCTS & CHEMICAL COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.



CP Two-Stage Air-Cooled Compressors

EXTREMELY compact, Class PM Two-Stage Air-Cooled Compressors are ideal for installation where floor space is limited. Durable Simplate Valves, effective intercooling, inlet valve unloading system and force feed lubrication afford high efficiency and minimum maintenance.

Class PM Compressors are available in direct-connected type with built-in or coupled motor, or V-belt drive, in sizes ranging from 78 to 445 c.f.m. piston displacement, for pressures up to 125 pounds. Write for a copy of Bulletin 759, 5th Edition.

There is a CP Air Compressor, stationary or portable, for every air requirement from 25 to 10,000 c.f.m. actual capacities and for pressures up to 5,000 pounds.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
HYDRAULIC TOOLS
ROCK DRILLS

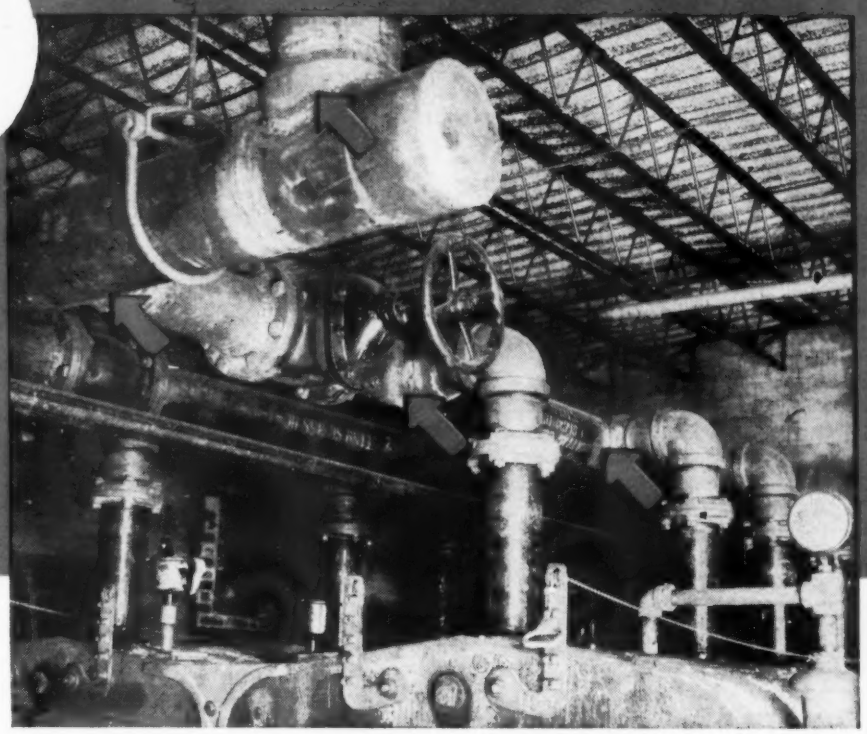
CHICAGO PNEUMATIC
TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

How to Simplify

BOILER-HEADER CONSTRUCTION



● Boiler Headers are perhaps the most vital part of any piping system. Adequate strength is necessary because a breakdown here means that the whole system has to be shut down. In addition, maximum efficiency of the system depends to a great extent on full capacity flow into every header take-off. To further complicate matters, take-offs are often close together and working room is usually at a premium.

The use of WeldOlet Fittings for making header take-offs will simplify these problems in practically all boiler-header construction jobs.

These fittings are designed so that they provide full original pipe strength at the joint and their funnel-shaped openings insure full flow into the branch lines. They also make it possible to place outlets close together, and require a minimum amount of working room. Only enough space is required to allow room for welding.

To get full specifications and description of these safer, more efficient, easier-to-install fittings, write today for the new 16-page WeldOlet Fittings Catalog.

Forged Fittings Division **BONNEY FORGE & TOOL WORKS • 342 Green Street, Allentown, Pa.**

WELDOLETS

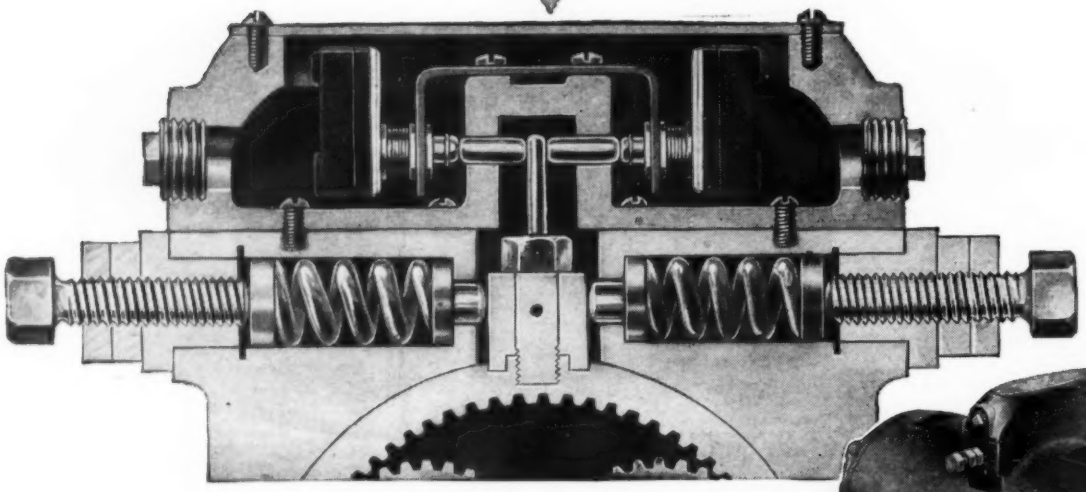
TRADE MARK REG. U. S. PAT. OFF. PAT. IN U. S. & FOREIGN COUNTRIES

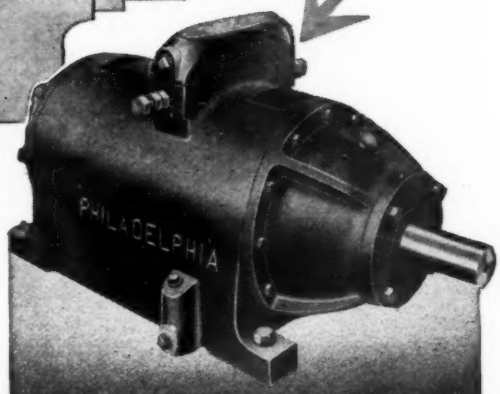
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET

For Welded Branch Pipe Outlets

Automatically and Positively—

GIVES INSTANT OVERLOAD PROTECTION





Philadelphia
PLANETORQUE MOTOREDUCER

The "exclusive" Philadelphia **Planetorque** is a feature that can be incorporated into any Philadelphia **MotoReduceR** (as seen from the illustrations herewith).

By direct *mechanical actions* of the overload, the motor *current is automaticaly and instantly cut-off, as soon as a predetermined load limit is reached.* This action is *quicker* and *more positive* than electrical thermal relays. With "fuse protection," the fuses must be selected to carry the starting current of motors; therefore, protection during the running period is not adequate. Incidentally, the **Planetorque** can be cut out during the starting period, by merely holding down the starting button, and upon release of said button it becomes operative again during the running period. To restart the **Planetorque** after it has cut-off from dangerous overload, merely remove the excessive load—a big time-and-money-saving feature.

The **Planetorque** is ideal for Stoker drives, Crushers, Mixers, Rolls, Pulverizers and a "hundred and one" other machines. Write for Catalog MR-45.

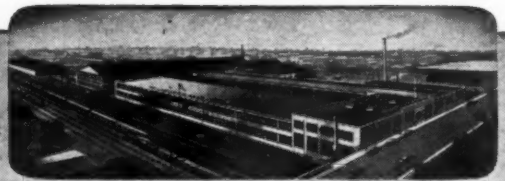
Philadelphia Gear manufacturers Speed Reducers of the following types: Worm, Herringbone, Spiral-Bevel, Helical, Spur, and Horizontal and Vertical **MotoReduceRs,** etc. Also, Limitorque Motor Operated Valve Controls,—and of course, any type, size or quantity of Industrial Gears. Literature regarding each Philadelphia Product sent upon request on your business letterhead.

Philadelphia

GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

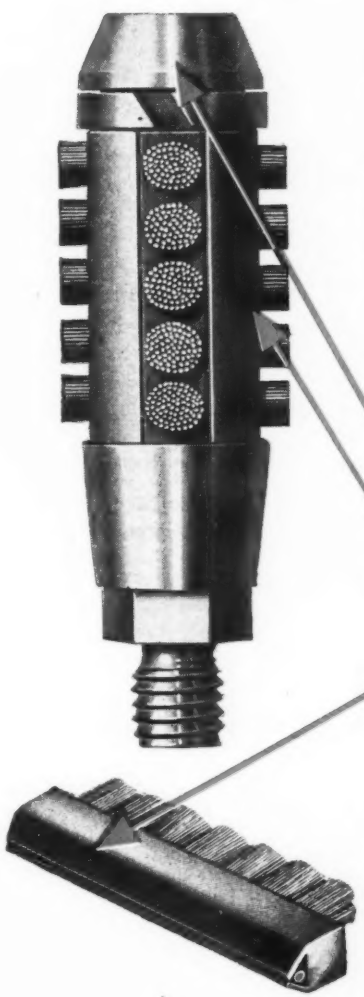


Industrial Gears and Speed Reducers
LimiTorque Valve Controls

ANOTHER WILSON FIRST!

NEW EXPANDING BRUSH CLEANS 1/2" I. D. TUBES

exclusive Wilson features assure efficiency and economy



For years the problem of removing deposit from very small tubes has stumped tube cleaning experts in the marine and power plant fields and driven them to expensive tube removal, pickling and replacement.

Now the need for this has been eliminated! Wilson engineers have developed a new expanding brush specially designed to clean the small tubes in heat exchangers, evaporators, condensers and similar equipment without necessity of removing tubes *or* bundles. This compact little brush — the smallest yet developed — removes light scales and other deposits in tubes as small as ½" I.D.

Small as it is, the *new* expanding brush incorporates features which have long enabled Wilson expanding brushes to make fast work of removing deposits for which they are designed. Here are just three of the many features.

1. **Replaceable retainers and caps take wear. Brush is as good as new when inexpensive cap is replaced.**
2. **Special case hardened steel makes possible longest brush body life.**
3. **Exclusive patented one piece cartridge design; substantial channel walls prevent tufts from "punching through" while solid, long-wearing side walls together with special bristles of steel, bronze, tampico, or nylon assure longest brush life.**

There is a Wilson Expanding Brush for every tube from ½" I.D. up . . . ferrous or non-ferrous, straight or curved.

Immediate delivery from stock. Write for additional information, addressing all communications to Dept. M.

THOMAS C. WILSON, INC., 21-11 44th Avenue, Long Island City 1, N. Y.

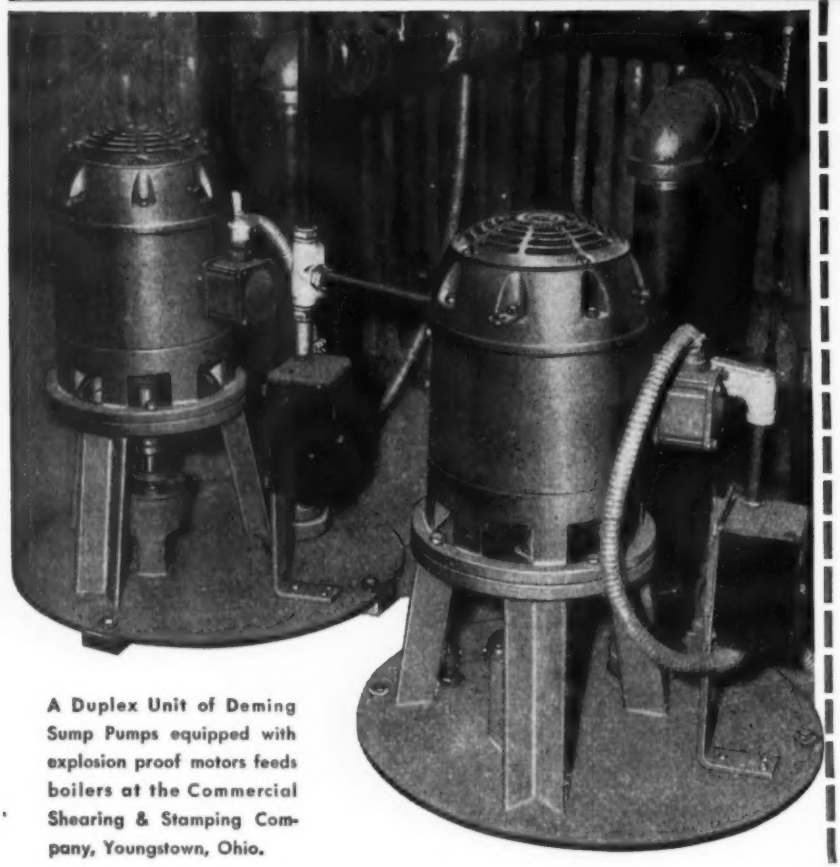
WILSON

TW-711

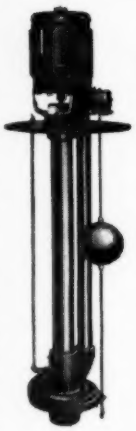
TUBE CLEANERS

VERTICAL construction • VERSATILE application

DEMING Sump PUMPS



A Duplex Unit of Deming Sump Pumps equipped with explosion proof motors feeds boilers at the Commercial Shearing & Stamping Company, Youngstown, Ohio.



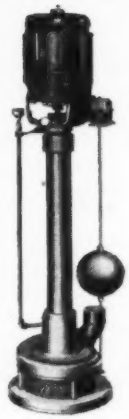
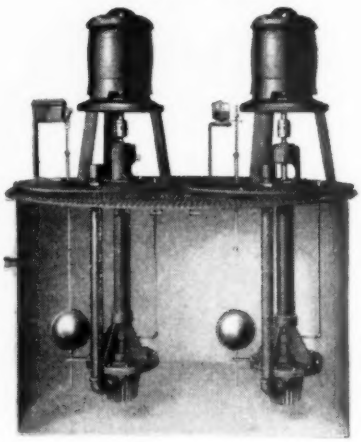


Fig. 4608 Deming Sump Pump is designed for requirements where a regular size is larger than needed and a cellar drainer is too small. Type "A" (at left) shows the unit supported from pit cover. Type "B" (at right) is designed for standing on pit floor.

DUPLEX UNITS



Deming Duplex Units are designed for installations where extra precautions must be taken to assure uninterrupted service. Two identical units are mounted on a large pit cover which has an 11" x 15" manhole through which access to pump may be obtained without removing either unit from the sump. Operation of the Duplex Units can be controlled in various ways to meet specific needs.

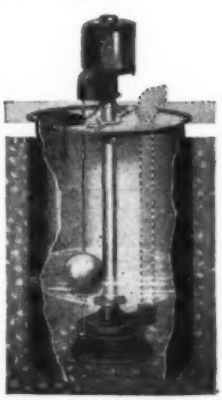
Features of Deming Sump Pumps extend their applications beyond their most common use for sump drainage to include such work as pumping heavy viscous or high temperature liquids from pits, handling screened sewage, and numerous other uses in varied industries.

Made for either wet or dry pit installations, Deming Sump Pumps are built in a wide range of sizes with capacities from 10 g.p.m. to 3200 g.p.m. with heads up to 120 feet and speeds from 860 to 1750 r.p.m. for motor drive.

Examples of Deming Sump Pumps are shown at the right. For detailed descriptions including performance tables and other data, write for illustrated BULLETIN NO. 4605. *A Deming Distributor is near you to serve you.*

THE DEMING COMPANY • SALEM, OHIO

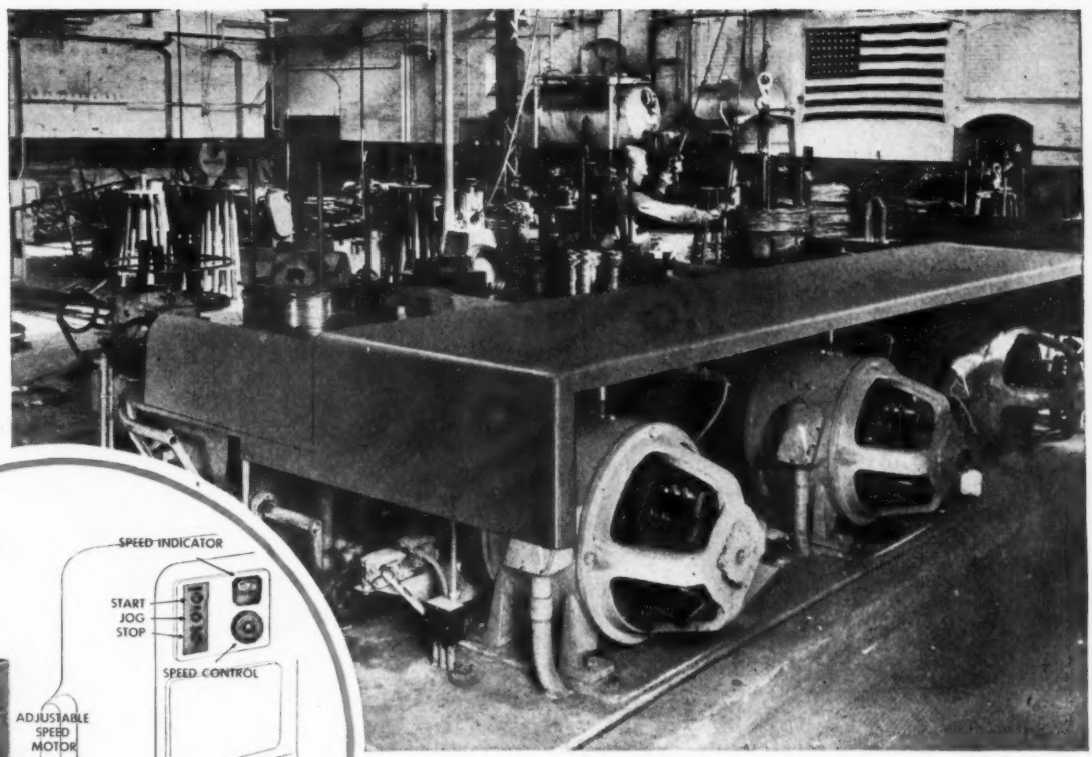
CELLAR DRAINERS

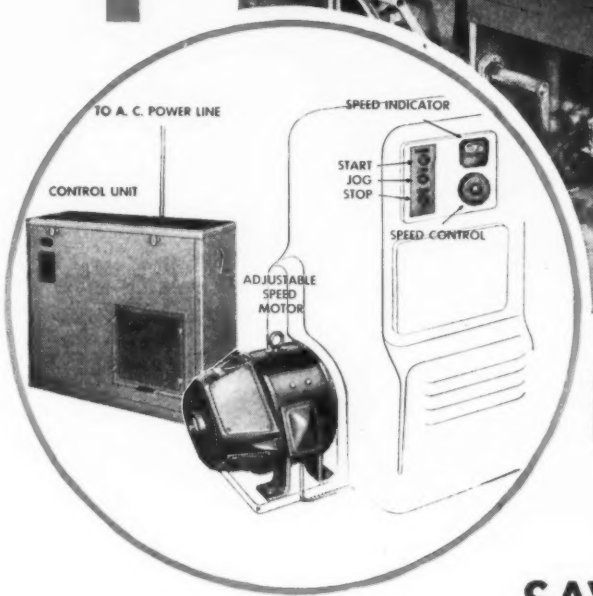


Deming Cellar Drainers (Fig. 4604) are entirely automatic in operation. These units are used for draining boiler rooms, tunnels, elevator pits, and for many emergency uses. Pumping capacity varies from 300 g.p.h. against a 24 ft. head to 3000 g.p.h. against a 5 ft. head.

DEMING
THE COMPLETE LINE
PUMPS AND WATER SYSTEMS

SPOT CONVERSION





Conveniently-packaged, space-saving V★S Drives are available in either Rotating or Electronic Systems or a combination of both systems.

RELIANCE V★S DRIVE

RELIANCE V★S DRIVE SAVES MONEY *by spot conversion of A-c. Power for Adjustable-Speeds*

V★S, the *All-electric, Adjustable-speed Drive operating from A-c. Circuits,* saves money in every plant it enters. Through spot conversion of A-c. power to provide adjustable-speed, it supplies an unlimited range of stepless speed changes. And does it without the expense of alterations in the plant power layout!

Other V★S features, such as starting, stopping and reversing by automatic or manual control from nearby or remote stations, plus the ability to maintain proper tension, are also helping to step up quantity and quality of production, while bringing costs down. Write today for Bulletin 311—the money-saving story of V★S Drive.

RELIANCE ELECTRIC & ENGINEERING CO.
1068 Ivanhoe Road • Cleveland 10, Ohio

Birmingham • Boston • Buffalo • Chicago • Cincinnati • Denver • Detroit • Gary • Greenville • Houston
Kalamazoo • Kansas City • Knoxville • Los Angeles • Milwaukee • Minneapolis • New Orleans
New York • Philadelphia • Pittsburgh • Portland, Ore. • Rockford, Ill. • St. Louis • San Francisco
Seattle • Syracuse • Tampa • Tulsa • Washington, D. C.

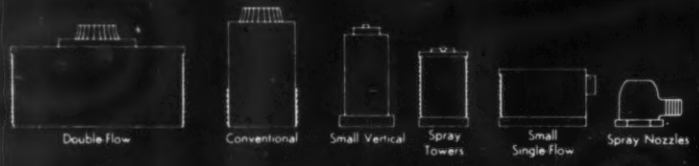
RELIANCE A-C D-C MOTORS *"Motor-Drive is More Than Power"*

MARLEY

THE MARK OF SUPERIORITY

. . . in design, construction

and operational excellence



MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

"You should've been on the boiler room job we just finished. We were covering lines that had 450° steam in 'em. Man, was it sizzling!"

"When you've worked for Armstrong as long as I have, son, you'll run into plenty of heat insulation jobs hotter than that one."

"I just hope keeping the steam up saves the customer as much money as they say it does, because it's doggoned hot work."

"Wait 'til you get on a really hot one! I worked on a job years ago . . ."

"Now, don't tell me it was any hotter than 450°."

"Sure was, and they had to get this plant running quick. So we put the high-temp block on the breechings after they fired up. And the gas in breechings used to run up to 700°!"

"About that time I'd have been begging to get on one of Armstrong's nice cool jobs—like putting cork covering in an ice cream plant."

"What, and get smeared with that sticky black cement! But ice cream is a good idea. Let's get some. It *is* kinda warm today, at that."

This story is fiction—but it is fiction based on what might have happened in any of the twenty-seven districts throughout the country where Armstrong men work. Our men don't enjoy working under difficult conditions, but they do take a good workman's pride in handling a tough assignment.

Almost every job has its own special problems, even though it's only cramped working quarters or moving machinery to keep clear of. The answers to all the problems encountered on heat insulation jobs aren't found in books. They have to be figured out on the spot by men with lots of experience. You'll find such experience in the mechanics, foremen, and superintendents who install both heat insulation and low-temperature insulation for the Armstrong Cork Company.

If you'd like to know more about these men and the type of work they can do for you, let us send you the free booklet, "Armstrong's Contract Service." We think you'll find it interesting. Just write to Armstrong Cork Co., Building Materials Div., 7008 Maple Avenue, Lancaster, Pennsylvania.

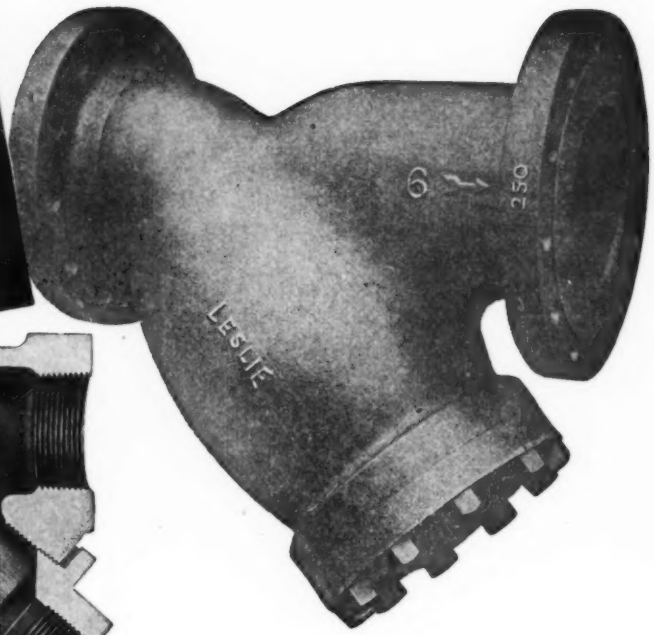
ARMSTRONG'S INDUSTRIAL INSULATION

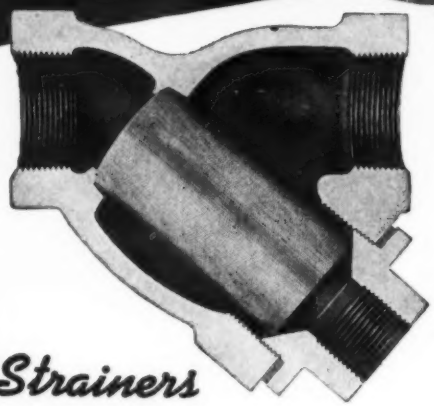
Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

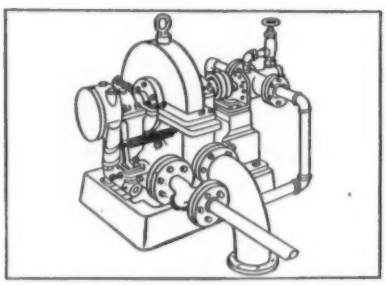
ON GUARD *against* RUST • DIRT • SCALE



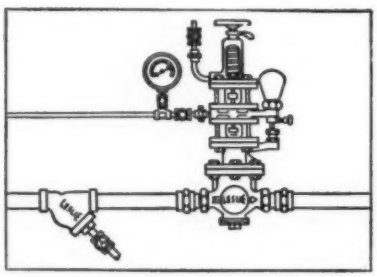


TRADE **LESLIE** MARK

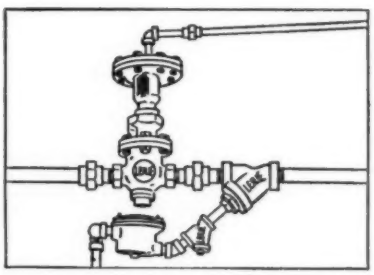
Self-Cleaning Strainers



1. TO PROTECT PROCESS MACHINERY



2. TO PROTECT REGULATORS



3. TO SEPARATE AND DRAIN

LESLIE Self-Cleaning Strainers provide the most inexpensive protection for valves, regulators, turbines, pumps, traps and similar equipment. They prevent *costly shut-downs* and heavy repair bills.

Self-Cleaning feature allows cleaning the screen without removal from strainer body or shutting-off the operating fluid.

Straight thread and gasket joint on *all* screwed end strainers permits easy removal of screen.

FOR ALL COMMERCIAL PRESSURES, they are available in the following body materials, connections and sizes.

Body Material	Connections	Size in Inches
Cast Iron Bronze Cast Steel	Screwed or Flanged	¼—8
Forged Carbon Steel	Socket Welding Ends	½, ¾, 1
Cast C-MO Steel		1, 1¼, 1½, 2
Cast Stainless Steel*	Screwed	½, ¾, 1

*Now available in stock.

SEND FOR Strainer Bulletin 465 containing new chart for computing steam pressure drops through strainers—no obligation.

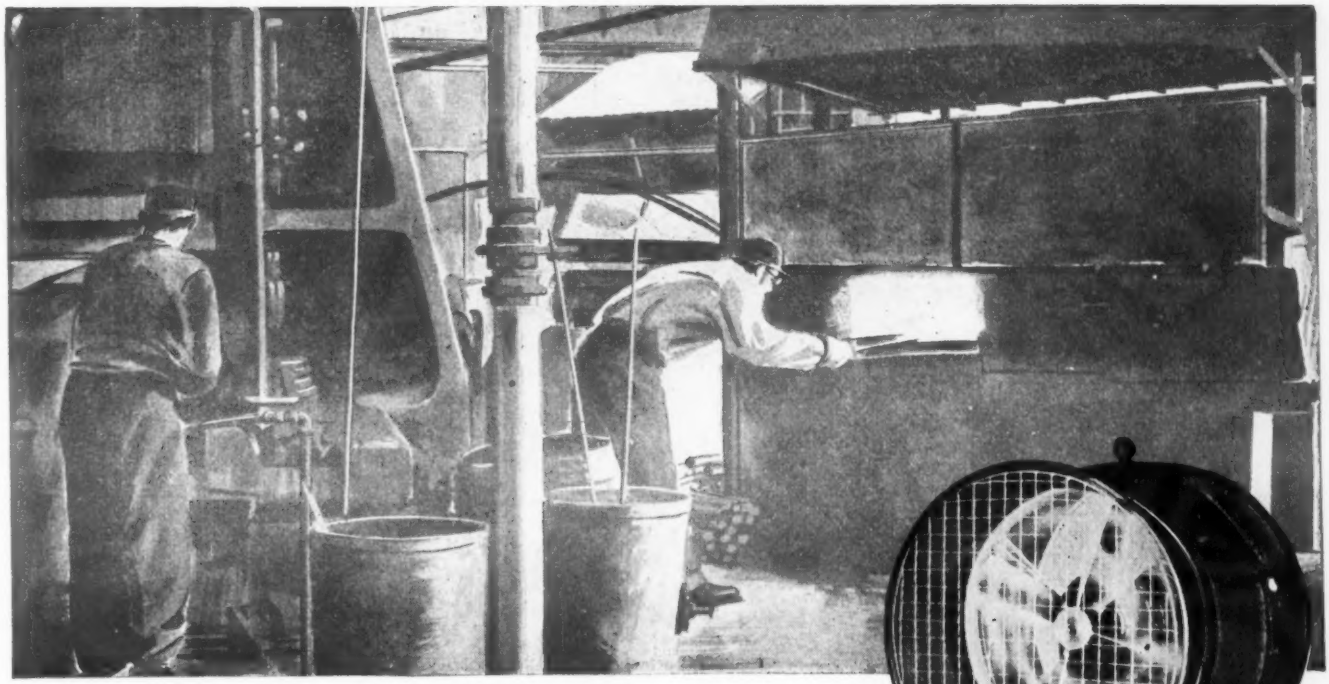
LESLIE CO.
255 Grant Avenue • Lyndhurst, N. J.

ESTABLISHED 1900 **LESLIE** CO.

Look for "LESLIE Regulators" in your classified telephone directory in these cities, for LESLIE factory-trained engineers to help you with your regulation problems:

Atlanta, Ga.
Baltimore, Md.
Boston, Mass.
Bridgeport, Conn.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Tex.
Detroit, Mich.
Greenville, S. C.
Houston, Tex.
Kansas City, Mo.
Los Angeles, Cal.
Louisville, Ky.
Milwaukee, Wis.
Montreal, Que., Can.
New Orleans, La.
New York, N. Y.
Orlando, Fla.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Ore.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.
Rutherford, N. J.
San Antonio, Tex.
San Francisco, Cal.
Savannah, Ga.
Seattle, Wash.
St. Louis, Mo.
Syracuse, N. Y.
Toronto, Ont., Can.
Troy, N. Y.
Tulsa, Okla.
Vancouver, B. C., Can.
Wilkes-Barre, Pa.
Youngstown, Ohio

PRESSURE REDUCING VALVES • PUMP GOVERNORS • PRESSURE CONTROLLERS
TEMPERATURE REGULATORS • SELF CLEANING STRAINERS • LESLIE-TYFON WHISTLES



COOL HEADS IN "HOT SPOTS" WON'T LET YOU DOWN

On jobs where the air is foul or hot, men can't be blamed too much for letting up now and then. If you want to keep their efficiency and morale high, feed them better air.

Employers have learned the value of putting Coppus Blowers and Ventilators on the job . . . in confined areas and near furnaces or hot processes. The men work faster, do better work, work longer without fatigue — and appreciate the more comfortable working conditions.

Give some thought now to the "hot spots" in your plant. There is a Coppus Blower for practically any requirement — Cable Manhole and Tank Ventilators, Boiler Manhole Blowers and Exhausters, Heat Killers, Shiphold Ventilators, etc. The Coppus "Blue Ribbon" is your assurance of design and construction planned for plenty of severe service. Check and mail the coupon for specific information. Address Coppus Engineering Corp., 408 Park Avenue, Worcester, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP., 408 PARK AVENUE, WORCESTER 2, MASS.
Please send me information on the Blowers that clear the air for action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausters, welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

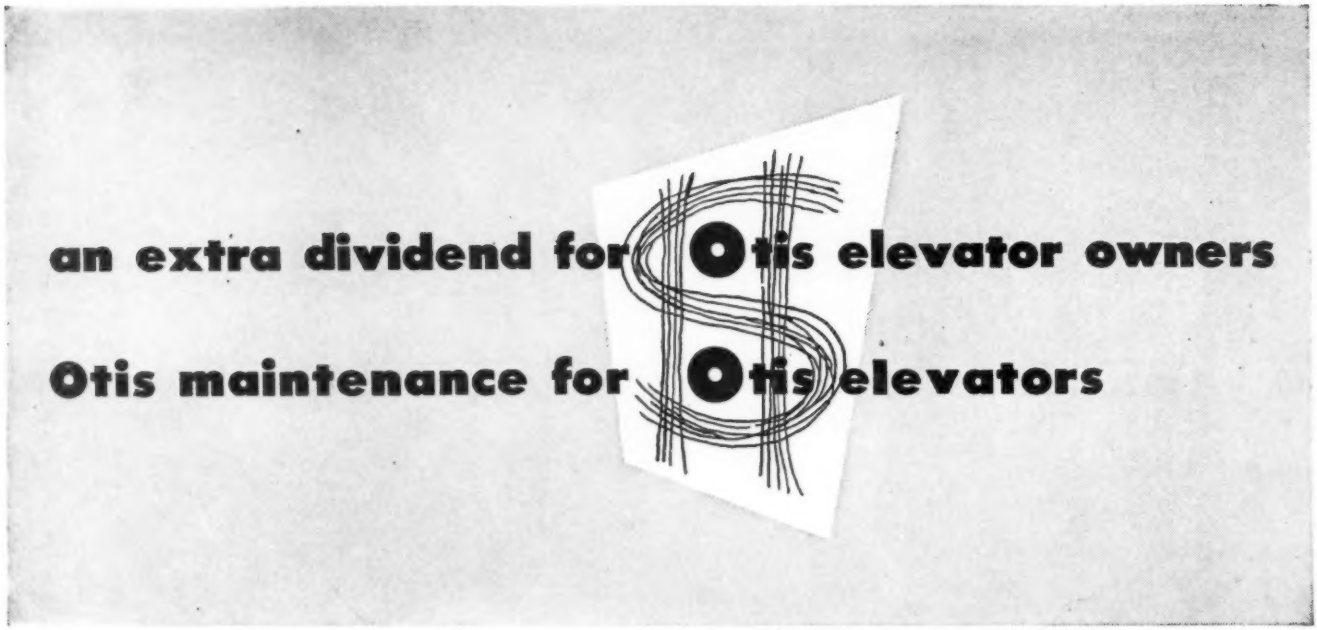
NAME.....

COMPANY.....

ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have).

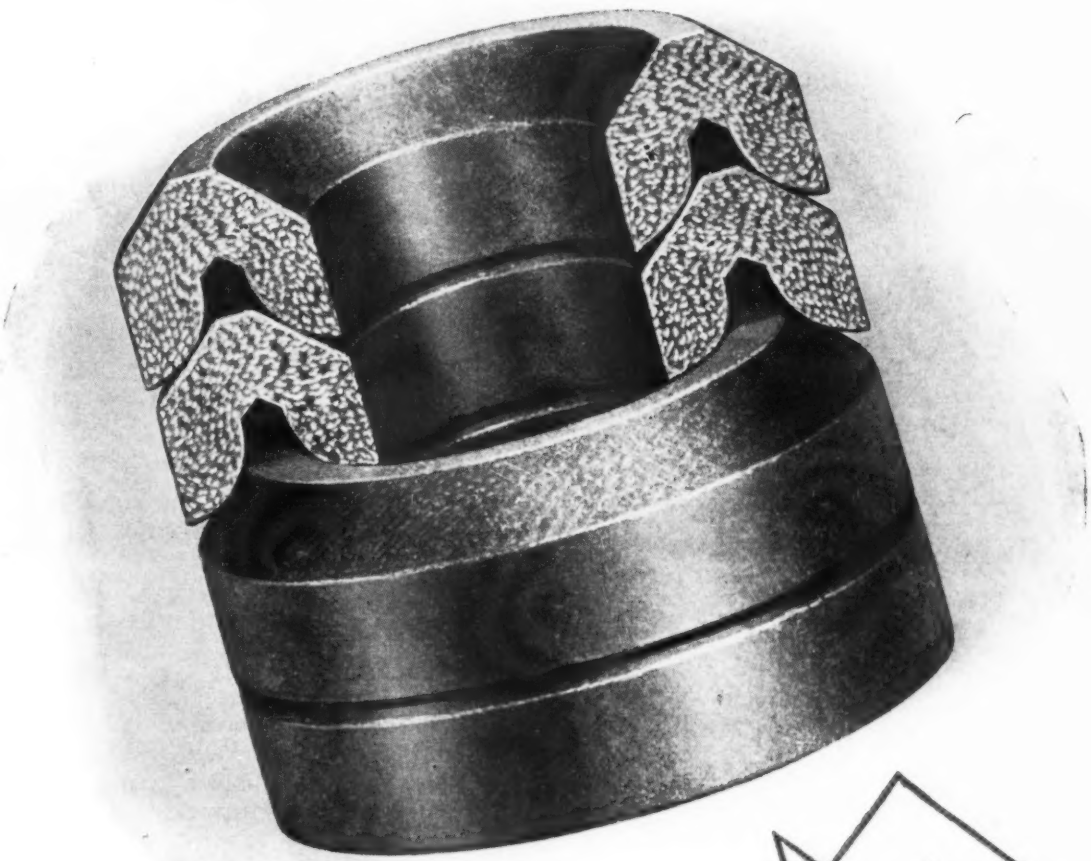


Otis Maintenance service is provided so quietly and with so little trouble to Otis elevator owners that many do not realize its true value to building management. ● Although it may not appear on the balance sheet, the value of this service may be measured in tenant satisfaction, more sales made or more freight moved, or in freedom from elevator care. It is especially valuable because of the spirit of the two thousand people who make up the Otis Maintenance organization. ● *Local* operations are conducted by 245 branch offices in 47 states, so that the men on the spot can act rapidly and effectively to give your building the best possible service. *District* and *zone* offices supervise field work and furnish supplies and emergency equipment. The *headquarters* organization provides all of the facilities and technical knowledge of the manufacturer. ● The service rendered is of such real and constant value that Otis Maintenance has more than doubled in volume every ten years. It could not thus increase without bringing the customers more than a dollar's worth of service value for every dollar spent. ● Otis Maintenance is a complete, flat-rate service for Otis elevators. It is available through your local Otis Elevator Company office.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

PALMETTO *Pyramid*

THE MOST TALKED ABOUT IMPROVEMENT IN MOLDED "VEE" PACKINGS



Engineers everywhere are talking about the newest addition to the PALMETTO family. PALMETTO Pyramid, a new design principle in all-purpose molded "Vee" type packings, seals completely with simple finger-tightening . . . and is *entirely automatic* in performance. A unique "arrowhead reservoir" stores and distributes lubricant. The result is reduced friction and less wear and that means longer packing life and longer equipment life.

GREENE, TWEED & CO.

Manufacturers of PALMETTO Packings

BRONX BLVD. AT 238th ST. NEW YORK 66, N. Y.

Plants at New York, N. Y. and North Wales, Pa.

FOR FULL PARTICULARS MAIL THE COUPON PLEASE

GT 1666

GREENE, TWEED & CO.

New York 66, N .Y.

☐ Send descriptive literature covering PALMETTO Pyramid Packings

☐ Send PALMETTO representative to discuss packing

Name .....

Company .....

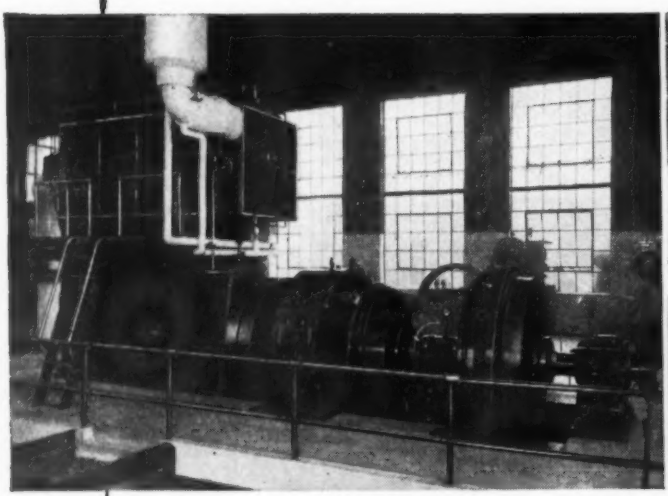
Street .....

City ..... *State* .....

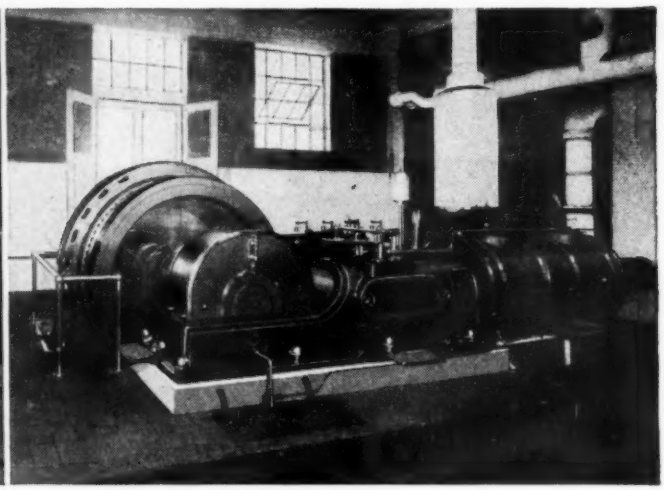
Skinner "UNIVERSAL UNAFLOW"

The Most Economical STEAM ENGINE Built

for Generating Electric Power or Driving Compressors, Blowers, Pumps, Lineshafts . . .



● 4-Cylinder Vertical 800-Kilowatt "Universal Unaflow" in Plant of Machine Tool Manufacturer



● 300-Kilowatt Horizontal "Universal Unaflow" in Meat Packing Plant

YEAR after year the sales of Skinner "Universal Unaflow" Steam Engines continue to grow; old customers install additional units; new customers replace purchased power with power generated under their own roof, or replace other types of prime movers with "Universal Unaflow" engines.

The "Universal Unaflow" is not just another steam engine; it is the outstanding reciprocating steam prime mover of this era. The performance of thousands of "Universal Unaflow" engines, in almost every type of industry and institution, daily demonstrates the truth of our claim—that they are "the most economical steam engines built."

"Universal Unaflow" engines are correctly designed for simplicity, dependability, heavy duty service, flexibility, and permanently maintained economy. They are built for direct connection, coupling, or belt drive, to electric generators, compressors, blowers, pumps, lineshafts, or other load. They are available in sizes ranging from 50 to 2000 hp., and in horizontal or multi-cylinder vertical types.

Write us for details, and for information about the performance of "Universal Unaflow" Steam Engines in your particular type of industry.

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

USE NICLOY TUBES for longer service in ALKALINE conditions... ...LOW temperatures

WHEREVER tubing is needed that is highly resistant to severe alkaline corrosion or to low-temperature embrittlement, B&W Nicloy Seamless Tubes can always be depended upon to provide the right answer. Because they have been developed expressly to combat those tube hazards, Nicloy Seamless Tubes give long, satisfactory service life, and at moderate cost. Nicloy Tubes are much more resistant to attack by alkaline media—and have higher impact values at sub-zero temperatures—than do any carbon steels and many of the usual alloy steels.

Nicloy Tubes are especially suited to such applications as these: handling crude oils with substantial salt water and hydrogen sulphide content; handling liquefied gases or other low-temperature fluids in such processes as oil dewaxing; in black liquor recovery units and evaporators of pulp and paper mills; for caustic solution evaporation and alkaline-phenol solution work.

Nicloy Tubing can be readily rolled-in, expanded, or flared and can be produced to standard dimensional tolerances. Investigate the advantages of Nicloy Tubing and let the B&W Research Staff help you apply Nicloy's superior service characteristics to your tough tube jobs. Write for detailed B&W Tube Specifications.

MINIMUM TENSILE PROPERTIES	
Ultimate Strength	60000 psi
Yield Strength	30000 psi
Elongation	30% in 2 in.

Other B&W Products

THE BABCOCK & WILCOX CO.

85 LIBERTY STREET • NEW YORK 6, N. Y.

Water-Tube Boilers, for Stationary Power Plants, for Marine Service • Water-Cooled Furnaces • Superheaters • Economizers • Air Heaters • Pulverized-Coal Equipment • Chain-Grate Stokers • Oil, Gas and Multi-fuel Burners • Refractories • Process Equipment.

BABCOCK & WILCOX SEAMLESS & WELDED TUBES

THE BABCOCK & WILCOX TUBE COMPANY

GENERAL OFFICES: BEAVER FALLS, PA.

PLANTS: ALLIANCE, OHIO AND BEAVER FALLS, PA.

TA 1343

Automatically

• • • cut in a boiler

• • • isolate a boiler

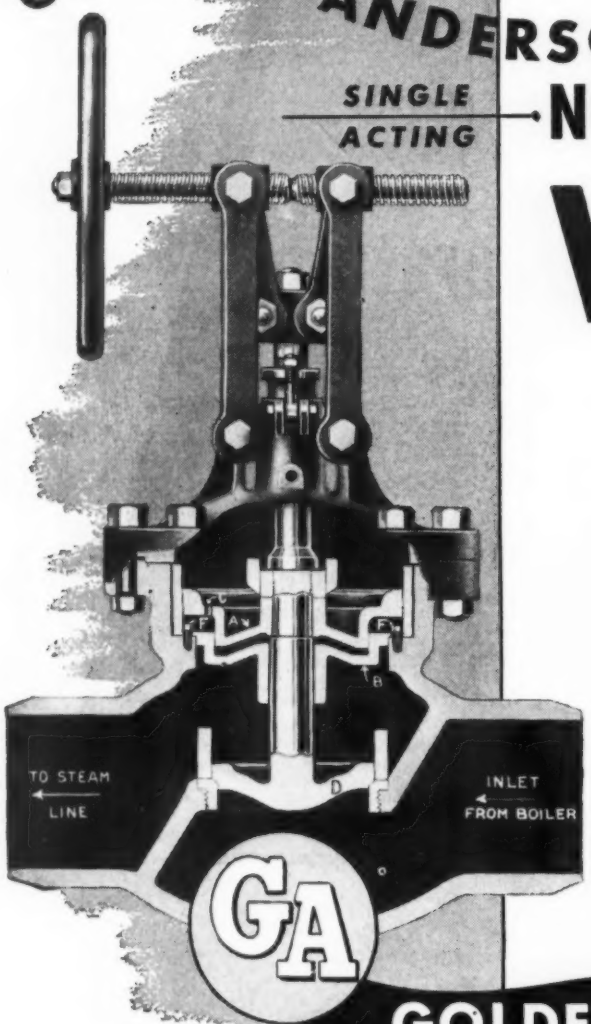
For absolute, dependable safety—choose GOLDEN-ANDERSON Non-Return Valves—they will automatically isolate a damaged boiler against reverse steam flow as well as closing down steaming boilers due to ruptured steam line or header beyond the valves.

GOLDEN-ANDERSON

SINGLE ACTING

NON-RETURN

VALVES



Available in series 600, 900, and 1500. Regular sizes from 2½ inch to 14 inch in Angle, Globe and Elbow Patterns; Special Sizes and Cross Pattern also available. Valves may be piped to any convenient boiler room station and by exhausting pressure from annular space between valve dashpots cause valve to close and thus prove it operative and reliable for any emergency operation.

Engineering Aid

For any problem involving high or low pressure, to meet practically any service requirement—call on GOLDEN-ANDERSON engineers.

GOLDEN-ANDERSON

VALVE Specialty Company

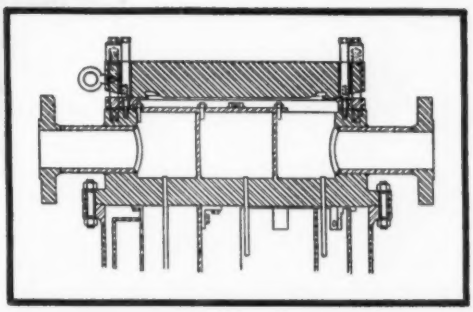
KEENAN BUILDING · PITTSBURGH 22, PA.

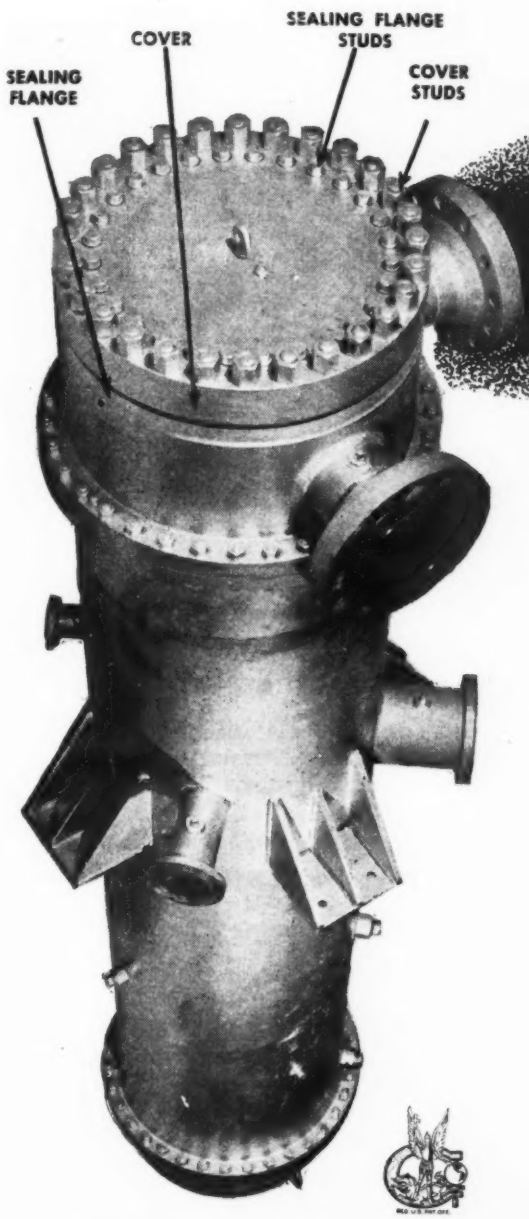
Other GOLDEN-ANDERSON Automatic **VALVES**

- Emergency Trip Valves
- Altitude Control Valves
- Pressure Reducing Valves
- Coke Quenching Valves
- Throttle and Automatic Engine Stop Valves
- Over 1500 Types and Sizes for Safe, Dependable Flow Control

A TIGHT HEAD-COVER JOINT

independent of main cover bolting and hydraulic load





IN THIS G-R EXTRACTION STEAM HEATER

No excessive wrench pull on the nuts is required to assure complete tightness of the head-cover joint gasket in the G-R Type Y Extraction Steam Heater.

This design has a separate sealing flange with an expansion member welded at its inner periphery to the cover. The cover carries the hydraulic load, and the sole function of the sealing flange is to provide only the necessary gasket contact pressure. The sealing flange is secured to the water head barrel by small studs with long nuts carried to the outside of the cover.

An additional advantage of the design is that the gasketed joint is visible, insuring immediate detection of any leak; and adjustment can be made without removing the head cover.

This is but one of the many distinctive features of G-R Extraction Steam Heaters. These heaters—available in a range of types for every pressure and capacity—are fully described in Bulletin 278 which will be sent on request.

THE GRISCOM-RUSSELL CO.

285 Madison Avenue New York 17, N. Y.

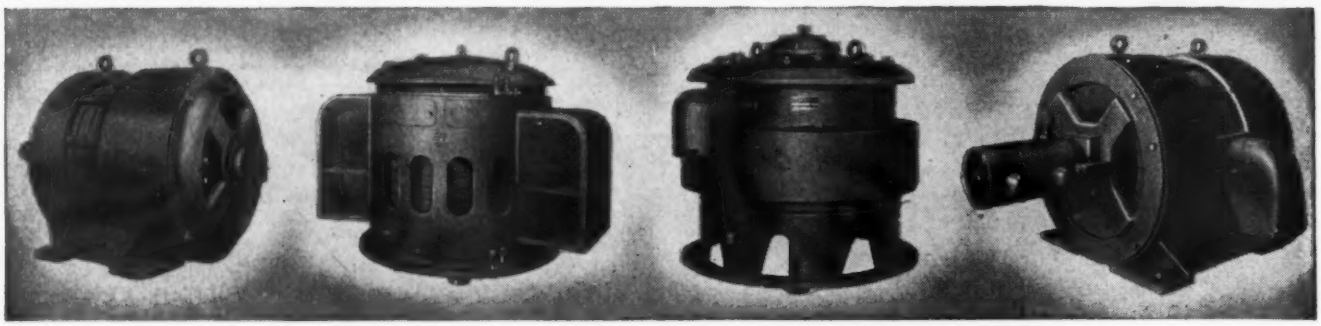
GR-128

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

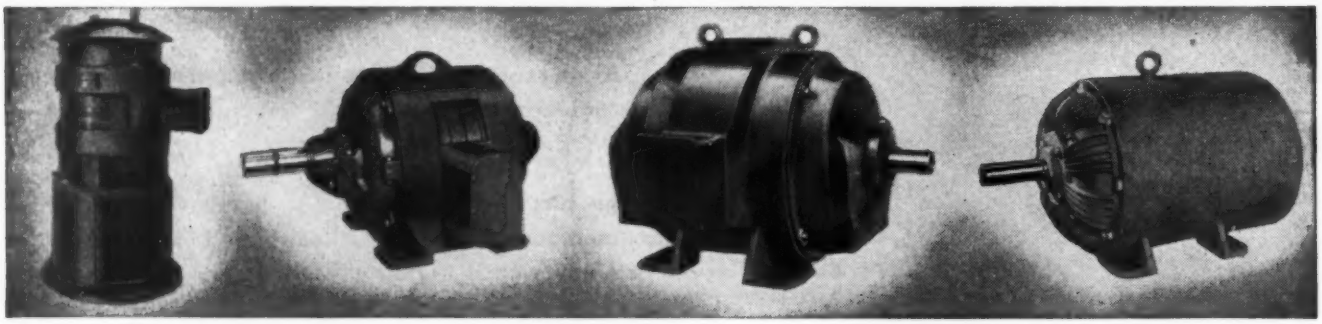
THERE'S ONE CORRECT INDUCTION MOTOR

• *that best fits into your plant*



200 Hp. Induction Motor | 400 Hp. Vertical Ind. Motor | 200 Hp. Squirrel Cage Vertical Ind. Motor | 300 Hp. 4-Speed Squirrel Cage Ind. Motor

25 Hp. Vertical Ind. Motor | 250 Hp., 1800 r.p.m. Ind. Motor | 30 Hp. Splash-proof Ind. Motor | 40 Hp. Fan Cooled Ind. Motor



BURKE INDUCTION MOTORS assume all kinds of types and sizes to meet specific conditions. They may be *Squirrel Cage*, with normal torque—normal starting current; normal torque, low starting current; high torque, low starting current or high torque, high slip. They may be *Wound Rotor* with constant or varying speed.

They may be multi-speed, drip and splash-proof, enclosed, enclosed fan cooled, vertical, flange, round frame and in sizes from 1 to 1500 H. P.

Consult with Burke engineers for that correct high quality induction motor *designed for the job.*

For a description of the complete Burke line of AC and DC motors and generators, consult Sweet's Engineering catalogs or Electrical Buyers Reference catalog.

For immediate assistance, contact:

ATLANTIC ENGINEERING CO.
185 17th Street, N. E., Atlanta, Ga., Phone: Hemlock 6461

J. T. COOPER
Room 1515 Engineering Bldg.,
205 West Wacker Drive, Chicago, Ill.,
Phone: Franklin 5061

C. E. WINCHELL
205 Perry-Payne Bldg., Cleveland, O., Phone: Cherry 5684

CARL D. MILLER
Roosevelt Theatre Bldg., Detroit, Mich.,
9595 Gartlet Avenue, Phone: Plaza 7232

J. B. COLESWORTHY
1709 West 8th St., Los Angeles 14, California
Phone: Federal 2021

MAXWELL-JONES-KELLETT INDUSTRIES
748 S. Claiborne Ave., New Orleans 13, La.,
Phone: Raymond 8241

L. B. RITCHIE
Room 1704, 274 Madison Ave., New York, N. Y.
Phone: Lexington 2-5350

B. A. AUERBACH
Room 234, 1600 Arch Street, Philadelphia, Penna.,
Phone: Rittenhouse 5226

F. E. BURKE
416 Maple Ave., Pittsburgh, Penna., Phone: Penhurst 5357

RALPH JAMES
Northwestern Agencies
2411 First Ave., Seattle, Wash., Phone: Elliot 8662

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

LONG HAUL OR SHORT... DEPEND ON

RUGGED BWH BELTS!

Long, grinding uphill work is the kind of job that tough BWH Conveyor Belts thrive on. And the operators of this South Carolina quarry... faced with the problem of obtaining a belt that would take just such terrific abuse... naturally turned to BWH.

Our engineers solved the problem by this triple Bulldog Conveyor installation. Millions of tons of sharp-edged granite have left the belts in excellent shape... and years of dependable service still lie ahead.

The secret of the enduring strength of these Conveyor Belts is the famous BWH ROTOCURE process, which produces belting free from press overlaps... uniformly vulcanized and stretched... and with a built-in durability that has meant enviable performance records!

When next you need a conveyor belt, look to BWH for dependable ruggedness... BWH distributors for dependable service!

HAVE YOU A JOB WHERE STAMINA COUNTS?
Bring us your toughest problems... we're specialists in solving them. Consult your nearest BWH distributor, or write direct.

BOSTON WOVEN HOSE & RUBBER COMPANY

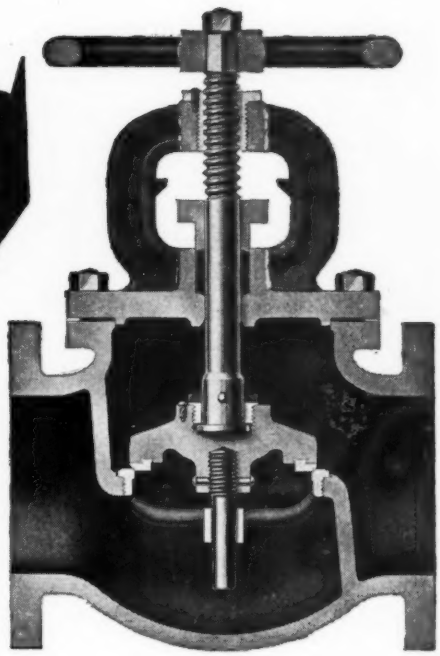
Distributors in All Principal Cities

WORKS: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.

Every feature you want in an

IRON BODY GLOBE or ANGLE VALVE

is in the KENNEDY DESIGNS



Notice the generous proportions, wide passageways with long curves, sturdy ribbed yoke with separate yoke nut, large handwheel, guided self-seating disc, renewable seat ring, and provisions for securely locking the disc, guide pin and yoke nut in place.

These are some of your assurances of extra strength and extra service when you install a Kennedy Iron Body Globe or Angle Valve. These valves are made in a full range of sizes for 125 lb., 150 lb., 175 lb. and 250 lb. steam pressure, with bronze-faced or renewable composition discs, and are also available in cross valve type. They are fully described in the 240-page Kennedy Catalog, which describes the entire Kennedy line of iron body and bronze gate, globe and check valves, malleable iron and bronze screwed pipe fittings, and cast iron flanged fittings and flanges. Write for your copy today.

Buy From Our Distributor

YOU WANT THESE VALVE FEATURES

. . . you'll find them in this KENNEDY design

1. **Generous Strength . . .** Body and bonnet are of high-grade dense metal with ample thickness and rounded fillets. Stem has large diameter and extra large number of contact threads.
2. **Easy Operation . . .** Stem and stem contact surfaces are accurately threaded. Deep stuffing boxes permit tightness without undue pressure on packing. Large handwheel gives firm, comfortable grip.
3. **Lasting Tightness . . .** Discs and seats seat accurately, and their sturdy design resists distortion and has special provisions for take-up of wear.
4. **Long Life . . .** Many Kennedy valves have been in daily use a quarter century and more.
5. **Convenient Repacking . . .** Glands and packing are easily accessible.
6. **Economical Maintenance . . .** Long wear built into all parts, and adjustments or other attention are seldom required.

THE KENNEDY VALVE MFG. CO.
Elmira, New York

KV-134

KENNEDY *valves - pipe fittings - fire hydrants*

MANHATTAN *OIL-PROOF* CONVEYOR BELT

MADE WITH FLEXLASTICS

. . . unaffected by oil-treated coal or coke

Paranite Oil-Proof Conveyor Belt carrying oil-treated coal in an illuminating gas plant

The first all-synthetic belt made for conveying coke was installed in 1936. It was made by Manhattan . . . and today after ten years, this original Manhattan Paranite Conveyor Belt is still on the job. This is due to Manhattan engineering in Strength Members and FLEXLASTICS to produce a conveyor belt to take abrasion and oil, while retaining its long life and elasticity.

Other installations of Paranite-G.O.P. (Gas-Oil-Proof) Conveyor Belts have been in successful operation for record periods in power stations, gas works, brick and tile, coke, asphalt, chemical and similar plants where oily substances are encountered.

Photograph below shows the first Paranite-G.O.P. Conveyor Belt 10 years old and still carrying coke to the top of a truck-loading hopper where oil is sprayed on the coke. A Paranite Oil-Proof Conveyor Belt will do equally well for you. Make your next a Manhattan Conveyor.

FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.

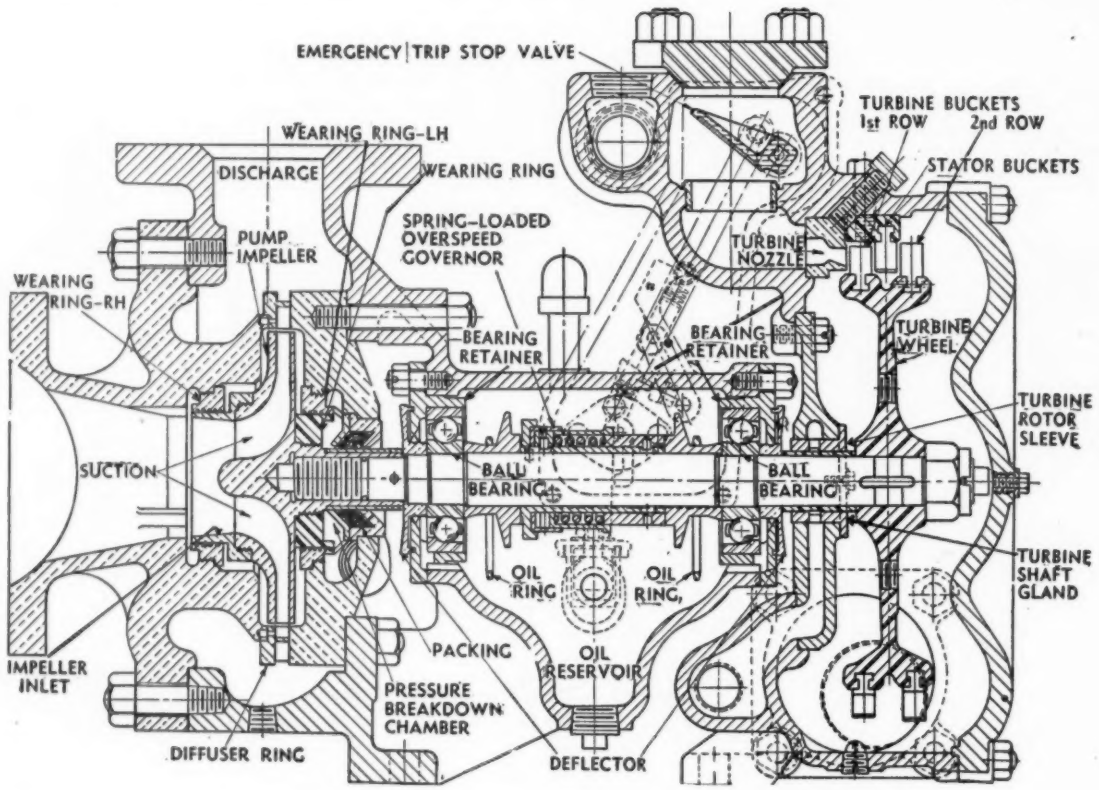
RAYBESTOS-MANHATTAN, INC.

MANHATTAN RUBBER DIVISION

EXECUTIVE OFFICES AND FACTORIES — PASSAIC, NEW JERSEY

14 ADVANTAGES

1. Not affected by oil
2. Will not soften
3. Cover will not swell, buckle or peel
4. Less coal spillage
5. Runs straighter on idlers
6. Less ply separation
7. Flexes better over small pulleys
8. Resists abrasion
9. Resists destructive effects of heat better
10. Non-spark
11. Mildew-proofed fabric
12. Increases production
13. Has longer life
14. Reduces cost



The Pump The Industry Is Talking About!

THE COFFIN TURBO PUMP

FOR BOILER FEED SERVICE

ONLY ONE UNIT — Centrifugal Pump, Steam Turbine

Capacities To	*Pressures To*
350 G. P. M.	*500 P. S. I.*

Saves Space, Weight and Steam

— Send For Descriptive Bulletin —

THE J. S. COFFIN, JR., COMPANY

326 SOUTH DEAN STREET, ENGLEWOOD, NEW JERSEY

REPRESENTATIVES

MOBILE, ALA.	MARINE SPECIALTY CO.	*8 South Water Street*
NEW ORLEANS, LA.	P. THOMPSON TOOL & SUPPLY CO.	*200 Tchoupitoulas Street*
NEW YORK	JAMES R. COE	*Room 2400, 220 W. 42nd Street*
PHILADELPHIA, Pa.	MALESON COMPANY	*970 Drexel Building*
PROVIDENCE, RI.	ARTHUR P. SISSON	*P.O. Box 55, Edgewater Station*
PORTLAND, ORE.	JOHN H. MARVIN CO.	*519 N.W. Park Ave.*
SEATTLE, WASH.	JOHN H. MARVIN CO.	*1016 First Ave, South*
SAN FRANCISCO	CORDES BROTHERS	*200 Davis Street*

GOETZE GASKET CHART
Cross-sections and Construction of Popular Gasket Designs
TYPE
No. 1200. A soft filler completely enclosed by a corrugated metal shell and corrugated metal top washer.
PROFILE. Heavy solid metal with concentric grooves.
GOETZE GASKET

The Only Complete Metal Gasket Line gives you 4 Real Advantages

- You get the *right* gasket for every application — not one that's *nearly* right.
- You get the benefit of complete laboratory and research facilities to assure you of 100% joint efficiency.
- You avoid unnecessary gasket troubles because Goetze can supply the most efficient and durable gasket for your particular conditions of temperature and pressure.
- You get the services of qualified Goetze representatives in 18 cities.

Specifications, engineering data and drawings of the Goetze line — the only complete line of gaskets — are available in Catalog No. 53. If you do not have a copy on file, send for one on your company letterhead. Or consult the nearest Goetze representative for efficient gasket service.

TECHNICAL BULLETINS

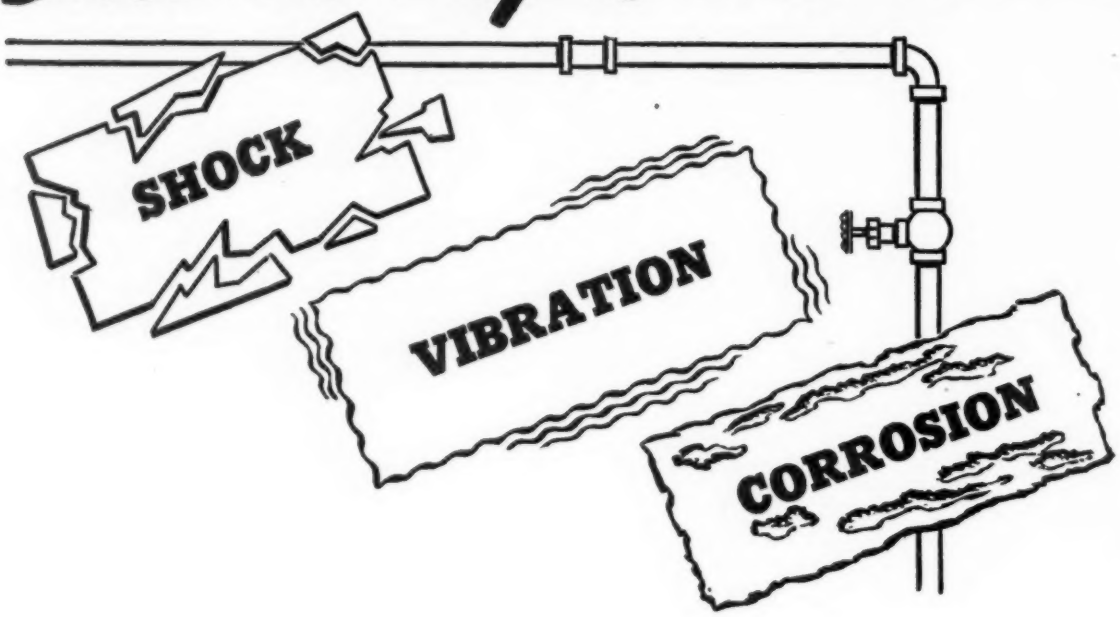
Ask to have your name added to the list of engineers receiving "The Gasket" — a series of technical bulletins containing original and useful gasket information from the Goetze Research Laboratory. Write on your company letterhead giving your position.

GOETZE GASKET & PACKING CO., INC.
10 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY

Boston	Cleveland	Detroit	Chicago
Cincinnati	San Francisco	Los Angeles	Buffalo
Houston	Philadelphia	Pittsburgh	Denver
New York	New Orleans	St. Louis	Montreal
	Toronto	Syracuse	

Goetze for GASKETS
"America's Oldest and Largest Industrial Gasket Manufacturer"

End the Triple Menace TO COPPER TUBE AND BRASS PIPE LINES



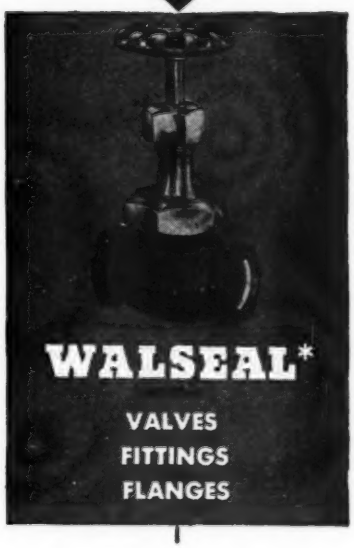
with THREADLESS SILBRAZ* JOINTS

Shock! Vibration! Corrosion! Yes, a Silbraz Joint made with Walseal* valves, fittings and flanges "has what it takes" to overcome this triple threat to copper tube (iron pipe size) and brass pipe lines—and for keeps.

Why? Because patented Walseal valves, fittings and flanges get their *extra* stamina from a ring of silver brazing alloy built right into each port . . . an alloy that when heated with an oxyacetylene torch flows out between the pipe wall and the fitting, making a joint that is stronger than the tube or pipe itself.

In thousands of installations, these Walseal products have proved beyond dispute that they make a "one piece pipe line" . . . a pipe line that does not creep or pull apart under any shock, vibration or temperature to which the copper tube or brass pipe can be safely subjected.

Write today to Dept. 84 for Catalog 42 giving complete data on Walseal products, as well as on the entire Walworth line.



Make it a "one-piece pipe line" with WALSEAL

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

*Patented – Reg. U.S. Patent Office

Eliminate DAMAGING WATER and OIL from Your Compressed Air Lines

WITH

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

Air Cooled to Within 10 DEGREES of Cooling Water! EASILY INSTALLED! Pipeline Construction

● **ADAMS** equipment insures a constant supply of cool, moisture-free, oil-free air to power your compressed air tools with the highest efficiency and safety . . . at the *lowest* installation and maintenance cost.

ADAMS AFTERCOOLERS are *guaranteed* to cool air to *within 10 degrees* of your cooling water. This means *extra* thoroughness in condensing water and oil vapors from your compressed air.

NO FOUNDATION or other facilities are required for installation. The Adams "pipeline" construction permits the After-cooler and Cyclone Separator to fit right into a section of the pipe line . . . either vertically or horizontally!

CYCLONIC SEPARATION is the Adams principle . . . engineers agree that it is *far more efficient* than other mechanical separation!

WRITE!

today for full engineering data on improved pneumatic power performance. Ask for Bulletin 703.

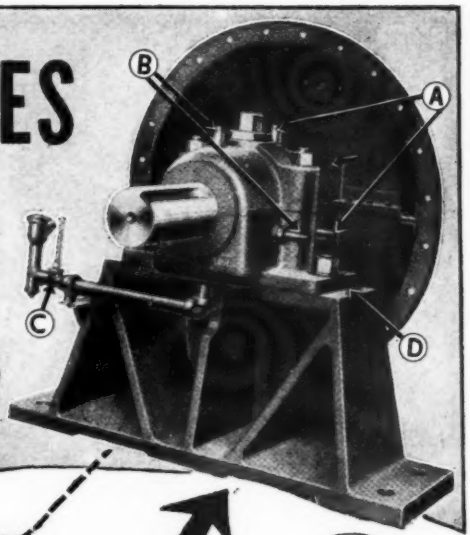
R. P. ADAMS CO., INC.

67 Chicago St., Buffalo, N. Y.

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS

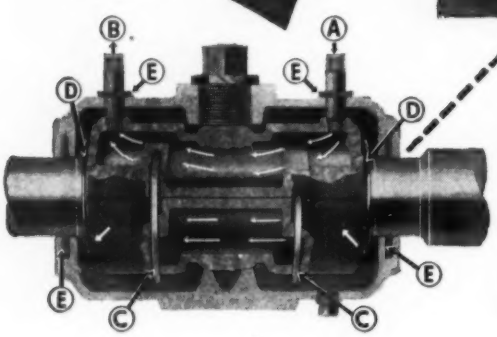
TWO CLARAGE FEATURES

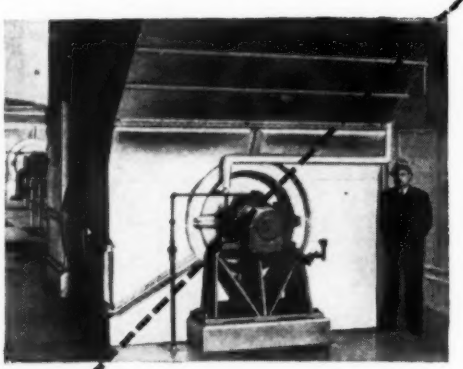
...that add up to better, longer service



A — Water inlets. B — Water outlets. C — Oil rings. D — Thrust collars (forged, turned and ground). E — Seals (bearings dust-proof and oil-tight).

1





2

A — Water inlets. B — Water outlets. C — Oil filler, gauge and pipe. D — Surfaces machined for accurate alignment. E — Shaft seal (no gas leakage from fan).

If you could drive your car as fast as Clarage RT Fans often operate, you'd get from New York to Chicago in slightly less than four hours. *That's traveling!*

And, in addition to high speeds, Clarage RT Fans must often combat high temperatures — *700° F. and even higher.*

The Clarage answer to such punishing demands is to furnish (1) specially designed, water-cooled bearings, and (2) extra heavy, pedestal-type bearing supports.

Sectional view at left indicates how cooling water circulates through each half of bearing sleeve independent of the other. No joints or gaskets; *water can't leak into bearing oil.*

NOW GLANCE ABOVE. Note the massive cast iron pedestals which afford rigid, unyielding support — *keeping all working parts in permanent alignment.*

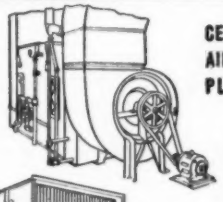
WRITE for Catalog 117

Clarage RT Fans are extensively used in power plants as both induced and forced draft units — and in many types of industrial process work. Our Catalog 117 reviews these fans. Request free copy today.

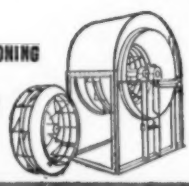
It's features like these that make the performance records of Clarage RT Fans (in mechanical draft and other tough applications) a "sweet" reading story of low-cost operation.

SOME OF OUR OTHER PRODUCTS

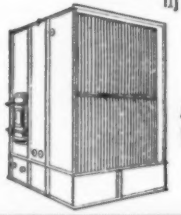
UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



AIR WASHERS

CLARAGE

FAN COMPANY

Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

SAVE 3 WAYS with Tube Couplings by PARKER

You'll save at every stage with Parker Tube Couplings. Here's why:

INSTALLATION is simplified—because the parts are self-aligning—and completely interchangeable, too.

OPERATION with Parker Couplings will give you sustained, trouble-free service. The famous patented design insures a pressure-tight, leakproof, vibration-protected joint.

MAINTENANCE is a routine matter, easily accomplished—even in tight spots. You can disassemble a Parker Coupling so fast that servicing requires only a few minutes of down time.

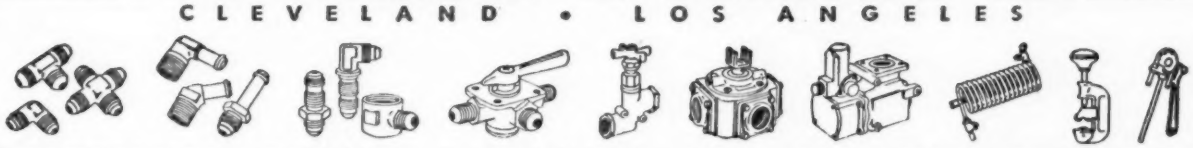
★

Parker Couplings are available in a wide variety of types—in steel, brass, stainless or aluminum—and in sizes from ⅛" to 1½", standard or heavy weight. You'll find complete information in our new catalog 201-C—yours for the asking, from your jobber—or write direct to The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio. In Canada, Railway & Power Engineering Corporation, Ltd., Montreal, P. Q.

★

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES

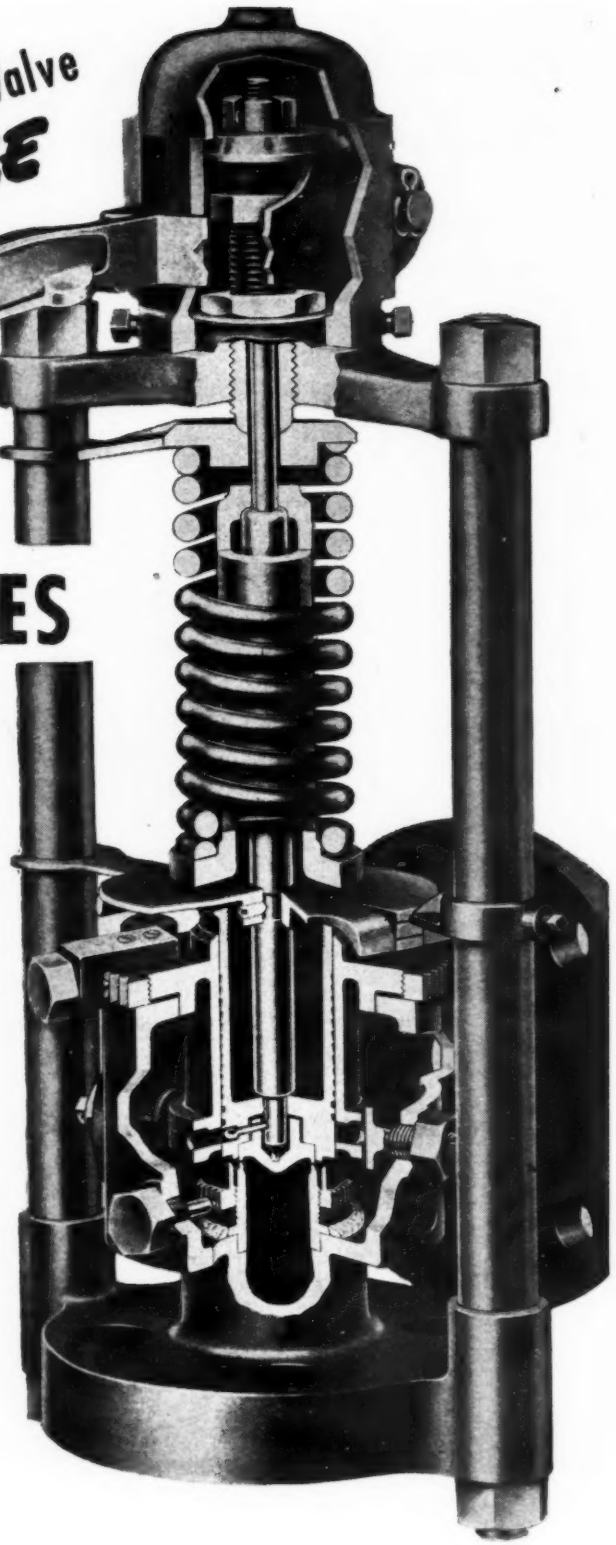


FLUID POWER PRODUCTS FOR ALL INDUSTRY

You Can See for Yourself . . .

WHY the Foster 38-SV Safety Valve is ESPECIALLY SUITABLE FOR

HIGH PRESSURES HIGH TEMPERATURES



Pressures up to 3000 pounds and temperatures of 1200° F. are easily handled by the Foster Type 38-SV Super-Jet Safety Valve—it was designed especially for just these exacting requirements! It's no mere "beefed-up" low-pressure valve—rather it's a basic new design for high-pressure service.

Only the Foster 38-SV Safety Valve gives you all these advantages:

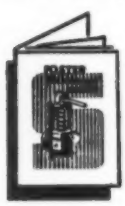
1 . . . ***Exceptional steam economy*** because . . . it reseats as low as 1% below popping pressure . . . reseating is positive; without pounding or chatter . . . blowdown is adjustable from 8% down to 1%.

2 . . . ***Unaffected by temperature changes*** because . . . frame rod construction makes crawl negligible . . . deflector protects spring and rods from escaping steam.

3 . . . ***Maximum protection*** because . . . full opening is practically instantaneous . . . full rated nozzle capacity is available at popping pressure . . . once set under operating conditions, its popping point is constant.

4 . . . ***Positive reseating*** because . . . floating disc design . . . steam-centered piston . . . permanently flat seats.

Specify the Foster 38-SV Super-Jet Safety Valve for the finest in high-pressure protection!



Complete details of the Foster 38-SV Super-Jet Safety Valve, for pressures up to 3000 pounds and temperatures up to 1200° F., are given in Bulletin 25. Write for it today!

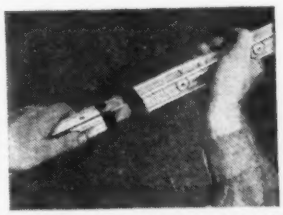
FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . AUTOMATIC STOP AND CHECK VALVES . . . ALTITUDE VALVES . . . DAMPER REGULATORS . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . LIQUID LEVEL CONTROLLERS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN AND TRIPLE DUTY VALVES . . . VACUUM REGULATORS OR BREAKERS . . . SIGHT FLOW BOXES . . . STRAINERS . . . SAFETY VALVES . . . SIRENS

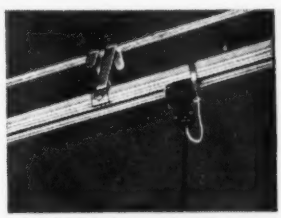
106 MONROE STREET • NEWARK 1, N. J.

Lights added or shifted without rewiring

A stepladder is the only equipment necessary to add new lighting fixtures with a BullDog Universal Trol-E-Duct system. Simply insert the weight-supporting clamps in the duct casing and tighten the lock nuts with your fingers. Then insert the twist-out plug in the duct casing and give it a quarter turn.

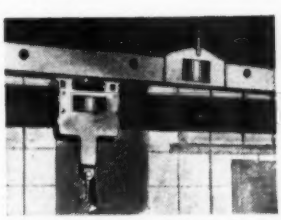


SECTIONS JOINED WITHOUT TOOLS. *Installation time cut to a minimum . . . special couplings snap into locked position automatically, hold sections together securely.*



COMPLETELY ENCLOSED FOR SAFETY. *Twistout plugs and trolleys collect current from copper bus bars safely enclosed in Universal Trol-E-Duct.*

BUSTRIBUTION DUCT FOR PLUG-IN POWER DIRECT TO MACHINE. *Machines moved without down-time for the rest of the line. A variety of circuit protective tap-off Bus Plugs for spotting and plugging in machines instantly, without rewiring.*



INDUSTRIAL TROL-E-DUCT MOVES THE POWER WITH THE TOOL OR LOAD. *Production rates go up — operating costs go down with this flexible system. Moving trolleys transmit power safely from duct bus bars to moving cranes, hoists and portable tools.*

You Can Do It With BullDog Universal Trol-E-Duct

You can have the *right light* in the *right place*—at any time and with little effort or expense. Miracle? Well, maybe just a small one. We call it Universal Trol-E-Duct.

In a plant equipped with Universal Trol-E-Duct, you can have light at the precise point where it's needed, because every inch of this continuous slotted duct is a potential electrical outlet.

You can add new lights of any type or you can move old ones. You can put small portable tools to work without long extension cords. And you can do both jobs without costly delays for rewiring.

Universal Trol-E-Duct is easily installed with prefabricated, standardized sections. Runs of duct can be altered, or completely dismantled and re-installed with complete re-use of all material.

For better production through better lighting, call a BullDog field engineer, or write for detailed descriptive folders.

BullDog also Manufactures Vacu-Break Safety Switches—SafToFuse Panelboards—Switchboards—Circuit Master Breakers—BUStribution DUCT for "plug-in" power—Industrial Trol-E-Duct for "moving" electrical loads.

BULLDOG

ELECTRICAL DISTRIBUTION SYSTEMS

BULLDOG ELECTRIC PRODUCTS COMPANY, BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN
In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities

20 HP Cyclotherm Steam Generator along side of 200 HP unit

A Cyclotherm for every steam need

These two trim, compact Cyclotherms give you an idea of how Cyclotherm meets every steam requirement—large or small.

Take a closer look and you'll see plenty of evidence of advanced design and engineering "know-how". Note how the burner, blower and accessories are integrated in one unit, easily removed with the boiler door making maintenance speedy and simple.

Among the many other engineering features incorporated in each Cyclotherm unit are:

- The exclusive Cyclotherm combustion and heat transfer principle that permits simple two-pass boiler construction with maximum operating efficiency.
- The Cyclotherm boiler and burner designed to operate as one unit for top fuel utilization.
- Heavy oil firing in models 50 HP to 200 HP with firing rates automatically modulated from 30% to 100% of rated capacity—without loss of efficiency.
- All models available with combination burner to fire either oil or gas. Changeover from one fuel to another is made by a simple adjustment.
- All components of Cyclotherm units are individually engineered or specially selected by Cyclotherm design engineers for *perfectly balanced operation.*
- Cyclotherm units are delivered fully equipped, tested and ready to operate after connection to water, fuel and electric lines.

Wire, write or phone for more information.

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 102, NEW YORK 4, N. Y.

VEELOS ON REELS

...Cuts Machine Downtime
...Cuts Belt Costs

TAKE out your watch and note the time required to replace an endless V-belt in your plant... then check with Veelos. With Veelos, the link V-belt, you can uncouple any desired belt length... couple it endless... install it on any drive *in just a few minutes.* The comparison, we think you'll agree, shows that Veelos "packaged" on reels is a big time saver.

A single reel of Veelos eliminates costly investment in a multitude of sizes of spare V-belts... simplifies stock records ... ends stockroom snarls caused by a confusing assortment of sizes. Each reel of Veelos holds 100 feet and requires only a negligible amount of space for storage.

Easy to take off the reel... easy to put on the drive, Veelos eliminates one cause of long, unprofitable work stoppages—helps keep production rolling. Speed up belt replacement... get real belt savings right off the reel with Veelos.

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

Eagle Super "66"

gives you America's outstanding insulation double feature!

1. Unsurpassed heat-saving efficiency

2. Rust inhibition on metal equipment

It's the truth—Eagle Super "66" Insulating Cement gives a combination of efficiency and rust inhibition that practical engineers and operating men have long looked for in insulation for metal equipment.

"Springy Ball" Structure

Secret of great heat-and-fuel-saving ability is its "Springy Ball" structure—small, resilient pellets of Eagle Mineral Wool containing countless dead air cells, Nature's most effective barrier against passage of heat. "Springy Ball" structure is retained permanently to give year-after-year heat-saving efficiency.

Thousands of actual applications in the field have proved conclusively that this unique insulation actually inhibits rust! This experience is confirmed by extensive laboratory tests. Ordinary insulating cements do not give this extra protection.

Super "66" has these 4 added attractions

It's all-purpose. Can be applied to almost any shape or size surface, and withstands a full range of temperatures up to 1800° F.

It's easy to apply. Just mix with water, apply to the surface to be insulated, and trowel to the desired thickness.

It's reclaimable. Even after being exposed to temperatures as high as 1200° F., it can be removed, remixed and re-used!

It has high coverage. Wet coverage is as high as 65 sq. ft. per 100 lbs. Shrinkage, which occurs in thickness only, is less than 15%.

Data sheets with complete technical information are available on request.

Other Eagle-Picher Industrial Products Include:

EAGLE INSULSEAL. A protective coating for insulation. Trowels on — dries to a hard finish. Withstands up to 450° F.

EAGLE "43" FINISHING CEMENT. A hard white finish coating for all types of indoor insulation within a range from 70° F. to 800° F.

EAGLE SWETCHEK (BLACK). A prepared, asphaltic base, rust-inhibitive anticondensation compound.

EAGLE-PICHER INSULATIONS
High and Low Temperature

EAGLE EP PICHER

THE EAGLE-PICHER COMPANY • CINCINNATI (1), OHIO

Eagle Super "66" Insulating Cement • Eagle L-T and M-2 Felt • Eagle Supertemp Block • Eagle Blankets • Eagle Pipe Covering
Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetchek

• *These aren't ordinary tank cars at all, for if they were they'd arrive at their destination empty—perhaps blown up. They are really "pressure vessels on wheels", designed to keep these gases liquified while in transit by maintaining them under pressures up to 300 lbs. or more.*

If you've ever seen such a car the chances are that a Taylor Forge Nozzle provided the outlet, for a large percentage of them are so equipped. These nozzles present an interesting example of the many unusual forged and rolled steel products we are called upon to make for handling liquids and gases under pressure—an example of forging operations that have contributed so heavily to the sum-total of knowledge that enables us to provide extra value in Taylor products in general and WeldELLS in particular.

Yes, extra value in WeldELLS . . . . and here's why. To make the best Welding Fittings that can be made you have to know two important things:

1. What constitutes "the best" design.
2. How to make the metal go where you want it to go in forming so as to provide that design in the finished product.

On the first count Taylor Forge is fully qualified by more than 40 years of the closest association with the piping and pressure vessel fields. And on the second . . . . well, it is only the broadest experience in controlling hot metal under pressure and impact that enables us to provide in WeldELLS all of the features listed opposite—features that are combined in no other welding fitting.

Read the list, please, and we will believe you will agree that

WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.
Los Angeles Office: Oviatt Bldg.

WeldELLS alone combine these features:

• **Seamless** — greater strength and uniformity.

• **Tangents**—keep weld away from zone of highest stress—simplify lining up.

• **Precision quarter-marked ends**—simplify layout and help insure accuracy.

• **Selective reinforcement** — provides uniform strength.

• **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.

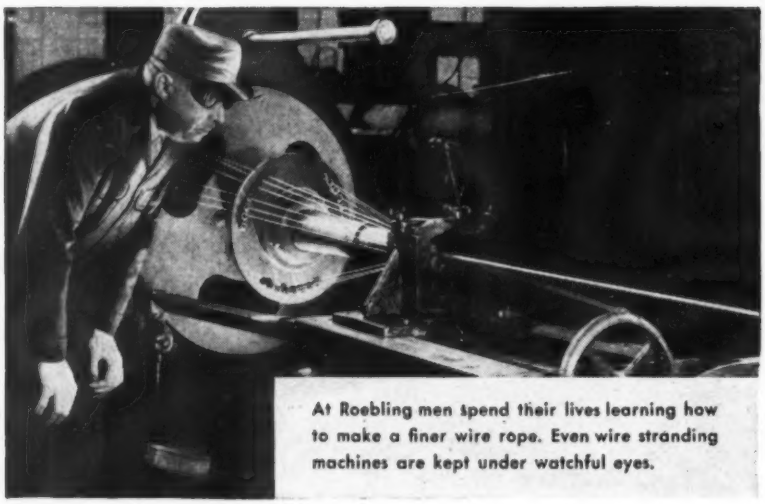
• **Wall thickness never less than specification minimum**—assures full strength and long life.

• **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.

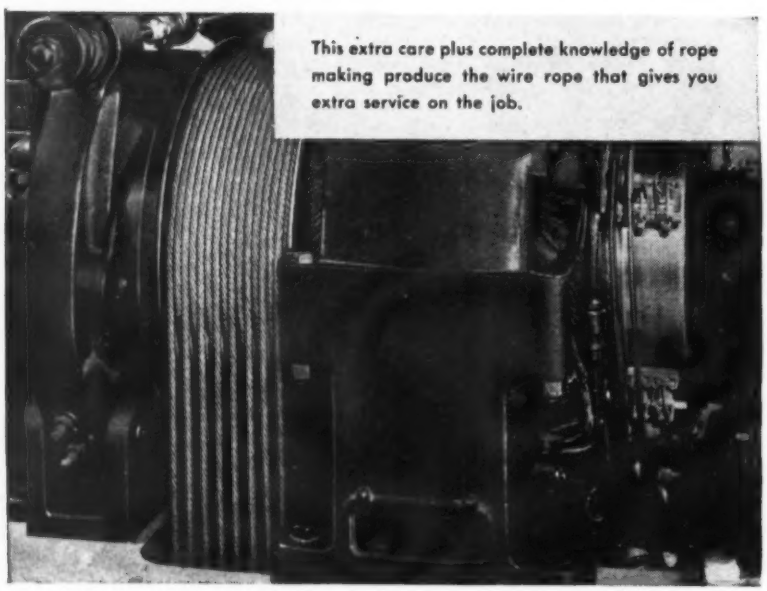
• **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

On *any* elevator: NOTHING SERVES LIKE

the right Wire Rope



At Roebling men spend their lives learning how to make a finer wire rope. Even wire stranding machines are kept under watchful eyes.



This extra care plus complete knowledge of rope making produce the wire rope that gives you extra service on the job.

To get the best service . . . the most life from your wire rope, it's important to use the *right* rope for the job. You need the correct balance of strength and flexibility, plus the peak in fatigue and abrasion resistance. In the wide range of sizes and types of Roebling Special "Traction Steel" Elevator Rope there is one that meets your exacting requirements.

Your local Roebling field engineer will be glad to help you specify the *right* wire rope—preformed or non-preformed—to give you the most service for the least cost. Call or write our nearest branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

Manufacturers of Wire Rope and Strand • Fittings • Slings • Aircord, Aircord Terminals and Air Controls • Aerial Wire Rope Systems • Ski Lifts • Electrical Wire and Cable Suspension Bridges and Cables • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Screen, Hardware and Industrial Wire Cloth • Lawn Mowers

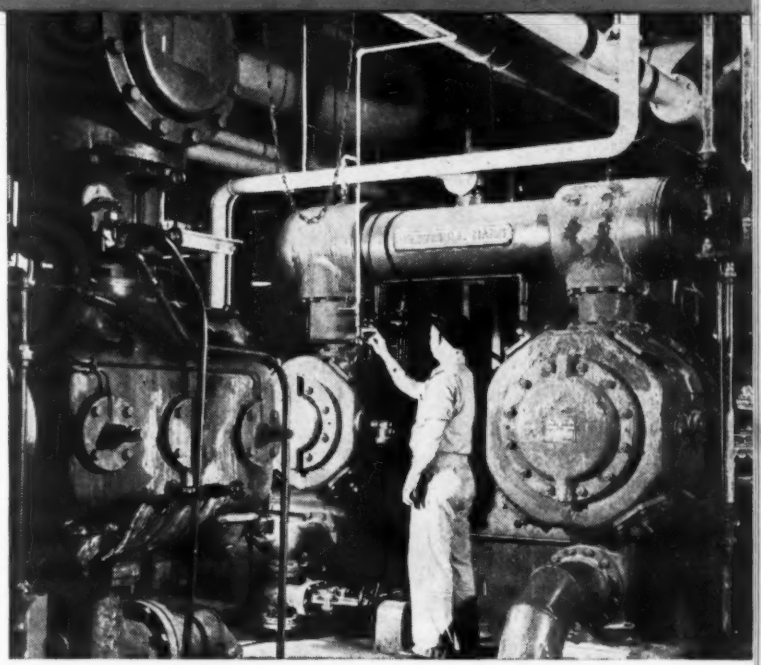
ROEBLING

PACEMAKER IN WIRE PRODUCTS

DOWELL

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

cooling jacket efficiency restored



Chemical cleaning removes scale —increases power!

Cooling jackets clogged with scale and sludge restrict engine efficiency, retard power output. To remove these *insulating deposits*, modern plant engineers call on Dowell—because Dowell's *chemical* cleaning method is thorough, economical and rapid. It's the modern way to restore designed operating efficiency—to remove scale—to increase power!

Dowell specialists offer a complete service . . . including careful selection of the correct solvent for your job—and they bring with them all treating required.

For more information on the *chemical* cleaning of compressors, gas engines, diesels, air conditioners—for boilers, condensers, filter beds—for water lines, for many types of *heat-exchange equipment*—and for increasing water well output—call the nearest Dowell office. Ask for free color booklet—"More Power to America's Industry!"

FREE SHOWING! Now available—a new 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. A Dowell representative will gladly arrange a special showing at your plant, office or organization meeting. Call or write Dowell today.

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

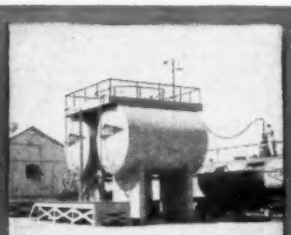
Subsidiary of The Dow Chemical Company

New York • Philadelphia • Baltimore • Buffalo • Cincinnati • Cleveland • Chicago
Detroit • St. Louis • Houston • Kansas City • Wichita • Pittsburgh • Mt. Pleasant, Michigan • Salem, Illinois
Long Beach, Casper: Dowell Affiliate—International Cementers, Inc.

SPECIALISTS IN CHEMICAL CLEANING SERVICE

Dowell's experienced industrial engineers are backed by the complete research and technical facilities of The Dow Chemical Company.

Dowell's equipment is modern and complete—scientifically designed. Treating stations and chemical warehouses conveniently located.



Dowell cleaning solvents are "tailor-made" to fit each job. All ingredients are of the highest quality, chosen for best results in your plant.

DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

SOMETHING NEW HAS BEEN ADDED

Kieley & Mueller presents

KONTROL MOTOR

Diaphragm Motor Valves
Pressure Regulators
Pump Governors

featuring

- ***All Steel Diaphragm Motor Unit . . .***
  lighter, tougher, stronger, more durable
- ***Boltless "Duoseal" Diaphragm Casing . . .***
  tight sealing, quick acting clamp ring; molded, highly flexible neoprene diaphragm
- ***Steel Tubular Yoke . . .***
  enclosing long, heat-treated, cadmium plated spring; packing gland and spring adjustment accessible through door
- ***Valve Position Indicator . . .***
  standard equipment; no extra charge
- ***High Capacity Valve Bodies . . .***
  unrestricted flow areas, smooth flow; available in bronze, semi-steel, cast steel, and special alloys
- ***Superfinished Disc Guides . . .***
  top and bottom guided Bevel, Percentage V Port, and Parabolic discs; minimum friction, increased life
- ***Modern Design . . .***
  to meet modern process requirements for better control

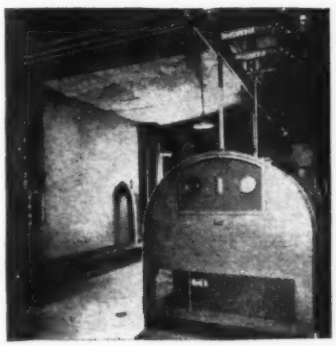
Write now for bulletin on the revolutionary KONTROL MOTOR valves.

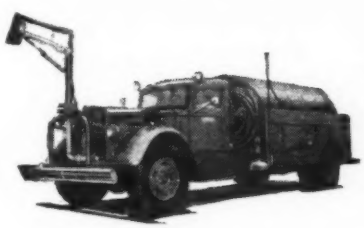
KONTROL KIELEY & MUELLER MOTOR

KIELEY & MUELLER, INC.
NORTH BERGEN, NEW JERSEY

Here's how CARDOX *has broadened the Scope of CO_2 Fire Protection*

Typical Examples of Cardox Fire Fighting Equipment





(1) Cardox Fixed Systems. Provide 500 pounds to 125 tons of liquid carbon dioxide. **(2) Cardox Fire Trucks.** Tons of CO_2 on wheels for application through hose lines or standpipe systems. **(3) Cardox Airport Fire Truck.** Uses mass attack to overwhelm vicious crash fires fast. **(4) Cardox Transitank.** Portable unit with a capacity of 750 pounds of carbon dioxide. Now available in certain parts of the country in hand propelled, and motorized models.

Expert fire fighters, who have seen Cardox Fire Fighting Equipment in action against fires normally hard to stop, rate the Cardox method of control and application of carbon dioxide a *significant* contribution to the whole field of fire protection.

As a result of this unique Cardox method, Cardox can engineer many types of fire extinguishing equipment utilizing *low pressure* liquid carbon dioxide in *pounds* or *tons* to provide protection for hazards indoors or out. As a result, the applications for which the recognized advantages of carbon dioxide are now practicable have been multiplied.

For example, Cardox methods of application and control have made it entirely practical to use this fast, non-damaging medium. (1) To provide tons of Cardox CO_2 on a high speed truck to guard widely scattered hazards. (2) To provide a single system capable of protecting multiple hazards throughout large plants. (3) To equip factories, hangars, etc. with a *portable unit* with sufficient wallop to deal with relatively large fires, (4) To protect banks of large transformers outdoors. (5) To overwhelm vicious airplane crash fires fast anywhere on large airfields . . . making possible speedy rescue of plane personnel and salvage of costly equipment.

All Cardox Fire Fighting Equipment has one characteristic: *The distinctive Cardox method of control and engineered application of carbon dioxide stored at 0° F. and 300 p.s.i. in a single storage unit containing from ¼ ton to 125 tons of fire-destroying Cardox CO_2 . . . enough to handle even large fires and leave an ample reserve for new emergencies.*

Mail coupon today for details on how Cardox's broadened application of carbon dioxide can best be utilized to increase the protection of your specific operation. Write for Bulletin 986.

CARDOX

—CO_2 FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices in **New York • Philadelphia Washington • Pittsburgh • Cleveland • Detroit Cincinnati • Houston • San Francisco Los Angeles • San Diego**

CARDOX CORPORATION
Bell Building, Chicago 1, Ill.

Send Bulletin No. 986 and full details on Cardox_____

*Name & Title*_____

*Firm Name*_____

*Street*_____

*City*_____ *State*_____

AHEAD OF THE FIELD

Warren "Realwear" Steam Pumps

4 new standard features at no extra cost!

Yes, Molded Piston Cup Packing, Stainless Steel Durabla Valves, Stainless Steel Piston Rods and All Steel Valve Gear (Bronze Bushed), are now *standard* features on Warren Horizontal Duplex Piston Pumps—"Realwear" Type! Standardization of these features . . . in addition to the many other advantages of "Realwear" design . . . gives you a pump that is far and away the leader in its field. Here are the advantages:

WARREN MOLDED PISTON CUP PACKING

Greater efficiency and lower operating costs because of minimum slippage . . . and longer liner life because of less wear when these cups are used.

Repacking made easier.

Much longer life of cups compared to ring packing.

Successfully handles practically all liquids . . . including hot water to 250° maximum at pressures to 1000 lbs. maximum . . . with standard cups and higher temperatures and pressures with special cups.

STAINLESS STEEL DURABLA VALVES

Achieve instant adjustment to variations in load; open only enough to allow passage of the flow; close instantly; eliminate slip; reduce cavitation, turbulence, and friction losses to a minimum; and permit pumps to operate at full load at slower speeds.

STAINLESS STEEL PISTON RODS

Insure maximum resistance to corrosion and wear.

ALL-STEEL VALVE GEAR (Bronze Bushed)

Adds strength and length of life to this constantly moving and important part of the pump.

WARREN MOLDED PISTON CUP PACKING

THE DURABLA VALVE

Completely open under full load

Partially open under light load

Write for information

WARREN PUMPS

WARREN STEAM PUMP COMPANY, Inc., Warren, Mass.

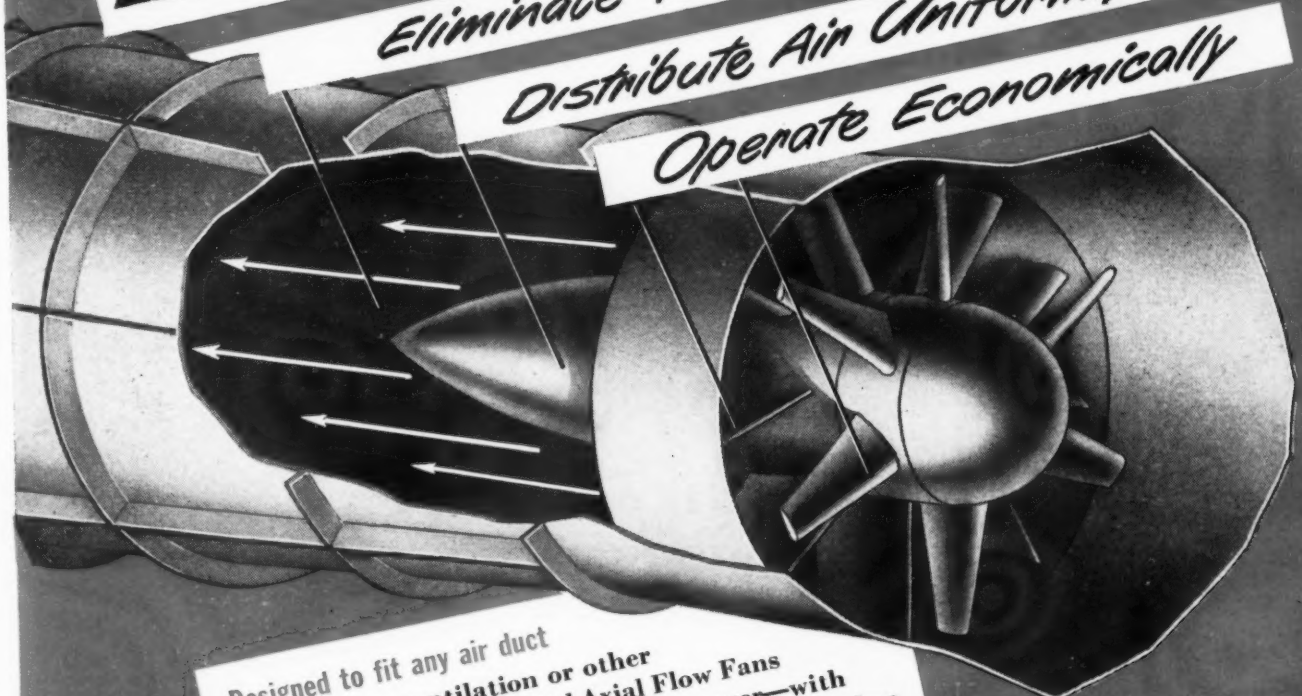
Axial Flow Fans
Guarantee
Efficiency

LA-DEL FANS – Troller Designed

Eliminate Turbulence

Distribute Air Uniformly

Operate Economically



Designed to fit any air duct

What's your ventilation or other air-movement job? La-Del Axial Flow Fans can do it in less space and with less power—with easy, low-cost installation and quiet, trouble-free operation. ● As specialists in Axial Flow Fans, let our engineers check with yours on futures.

Consult a Joy Engineer

LA-DEL Division

JOY MANUFACTURING CO.

NEW PHILADELPHIA, OHIO

How BERNITZ BLOCKS are helping check labor turnover in hundreds of boiler plants

DUE to restrictions on the flow of coal from one field to another, many boiler plants have to burn coal for which their equipment was not designed. Lower quality fuels also have to be burned at higher rates to maintain capacities. Clinker adhesion and ash removal problems are intensified, and the extra labor burden falls on the boiler room crews.

Moreover, demands on manpower have made the boiler room jobs tougher for those who are available to carry on. Sometimes the added load is too much to bear. The natural thing to do when a job gets too tough is to look for an easier one.

BERNITZ SUPER BLOCKS are helping to check labor turnover in many hundreds of boiler plants today. By keeping the walls free of clinker they minimize the work required for cleaning and dumping fires; maintain 100% active grate surface at all times. In short, they improve working conditions.

As the chief engineer of a large paper mill in Michigan recently put it: "If we had to go back to the days before we installed Bernitz Blocks, using the coal we have to burn today, my gang would walk out of here."

BERNITZ SUPER BLOCKS reduce maintenance to settings and reduce furnace outage, contributing further to overall economy in the expenditure of man-hours of labor.

BERNITZ SUPER BLOCKS are made of "Carbofrax",* the silicon carbide refractory which inherently resists clinker adhesion. By taking advantage of the high thermal conductivity of "Carbofrax"* with shapes correctly designed for large air contact area, BERNITZ SUPER BLOCKS can be easily cooled below the fusion temperature of the ash. Write for free descriptive Bulletin B-344.

*"Carbofrax" is the registered trade mark of, and indicates manufacture by, the Carborundum Company.

BERNITZ FURNACE APPLIANCE CO.

89 BROAD STREET, BOSTON 10, MASS.

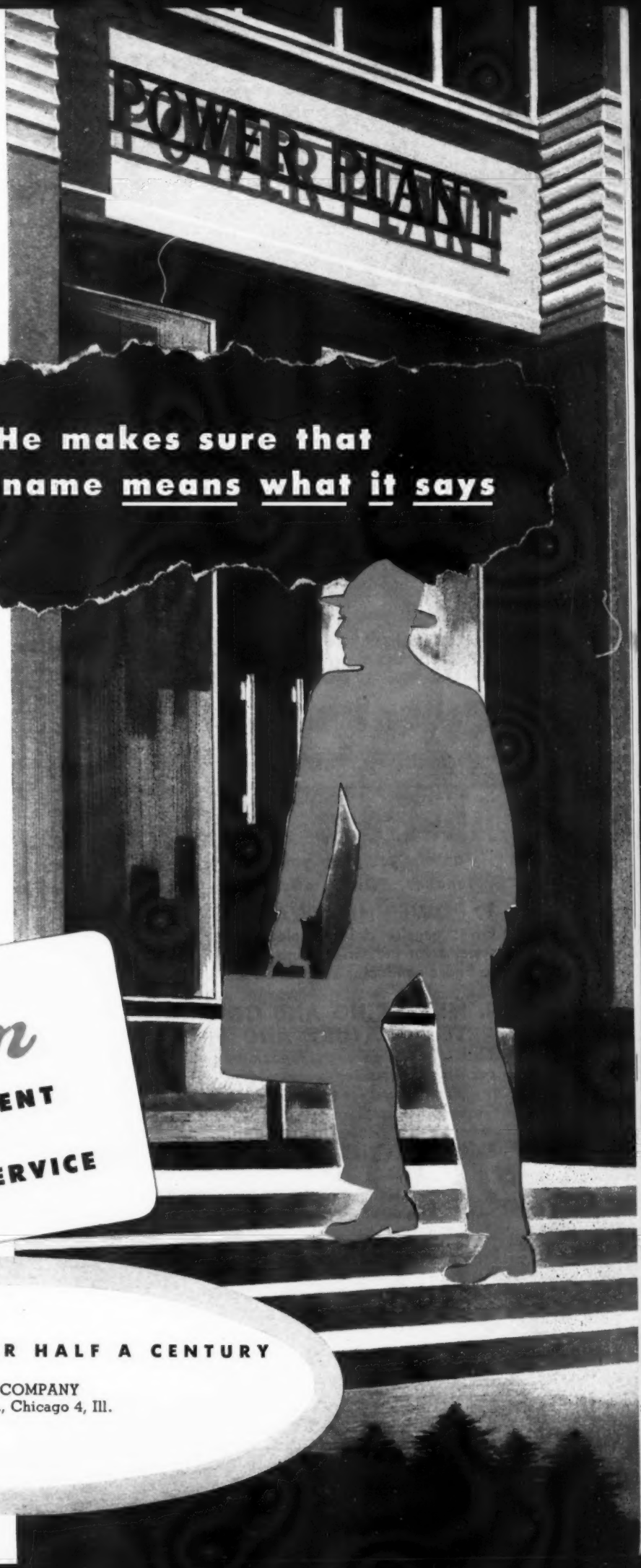
New York Philadelphia Detroit Buffalo Syracuse Atlanta Pittsburgh
Cincinnati Chicago Indianapolis Minneapolis St. Louis Cleveland
In Canada: Williams & Wilson, Ltd., Montreal and Toronto

BELOW: After 18 months' heavy usage (300 to 350% ratings) and only occasional Sunday shutdowns, these Bernitz "Carbofrax" Blocks are in almost new condition.

AT RIGHT: Rear view of Bernitz all "T" construction blocks.

BERNITZ SUPER BLOCKS

OTHER PRODUCTS INCLUDE: BERNITZ FURNACE LININGS • BERNITZ NYGAARD WATER WALL • BLOCKS FOR WALLS AND ARCHES • BERNITZ AIR-COOLED FLOORS
BERNITZ SUPERGENERATOR LININGS FOR WATER GAS SETS



From the moment the Dearborn Engineer steps in your door, he is in your service.

He starts by making a thorough study of your boiler operating conditions.

He sends water samples to the Dearborn laboratories where accurate chemical analyses are made. Laboratory experts recommend the proper treatment and control methods for your complete protection.

. . . He makes sure that name means what it says

DEARBORN SERVICE TAKES TROUBLE OFF YOUR HANDS

If chemical feeding equipment is necessary, suitable means are recommended, making use of the versatile line of Dearborn mechanical equipment. He instructs your operators how to use the testing apparatus in connection with treatment adjustment and blowdown control. Thereafter, he makes periodic checks to insure maintenance of recommended boiler water conditions.

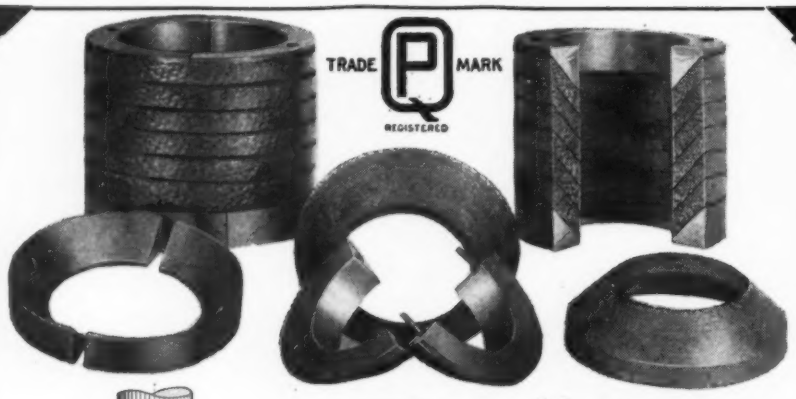
This service, indeed, means that your plant is set to deliver power!

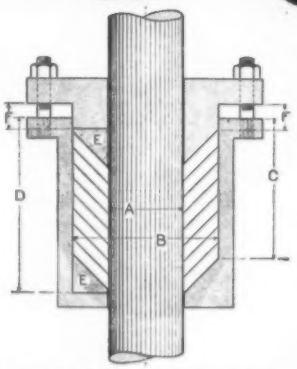
Dearborn
TRADE MARK REGISTERED

WATER TREATMENT AND ENGINEERING SERVICE

THE *LEADER* FOR OVER HALF A CENTURY

DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave., Chicago 4, Ill.





Q Self-Setting Q-P PACKING

Q-P Self-Setting Packing has demonstrated its superiority under the most difficult conditions on land and sea and can be depended on to meet post war requirements for high maintenance economy. It is the ideal packing for superheated steam, saturated steam, hot and cold water, ammonia, fuel oil, compressed air, gases and acids and other operating conditions. (For Valves, Turbines, Diesels, Expansion Joints, Hydraulic Equipment, etc.).

(Outline your Packing Problems and Let us show you what "Q-P" Self Setting Packing can do for you.)

THE Q-P MANUFACTURING COMPANY
NEEDHAM HEIGHTS 94, MASS.

TO HELP YOU WITH FUTURE POWER PLANNING

A Special section on GAS TURBINES

20 pages summarizing the latest developments in this field.

(Note: This section was formerly scheduled for September POWER.)

Answers to Today's POWER Problems

To help you keep your plant running at top efficiency, to eliminate waste and to aid maintenance, POWER offers these reprints, designed for quick reading by the power engineer:

1. POWER HIGHWAYS—
Gives concise data on electric-power distribution systems for industrial plants, equipment used, how to figure conductor sizes for ac and dc feeders, etc. Price 15c

2. MEASURING AND CONTROLLING TEMPERATURE AND PRESSURE—
32 pages of data on fundamentals and devices available to register pressure and temperature. A practical manual for the man in the plant who needs fingertip information for quick, sound solutions of metering and control problems. Price 40c

3. ISOMETRICS FOR POWER ENGINEERS—
A short course in the easy and useful art of isometric sketching. Skill in this kind of picture making saves time and improves power planning, construction and operation. Price 10c

4. HYDRAULIC DRIVES—
A handbook of practice on an important phase of mechanical power transmission. Covers construction, operation and characteristics of hydraulic couplings, torque converters and variable-speed transmissions. Price 10c

5. STEAM TURBINES*—
A practical textbook for power men, covering fundamental principles, construction details, types and applications, governing, lubrication, operation, maintenance and methods of estimating performance. 48 pages. Price 50c

6. MAGNETIC DRIVES—
Many plants are applying magnetic drives for solution of transmission problems. Here is a 8-page digest of the different types, how they operate, how best used to fit various needs. Price 10c

PLEASE ORDER BY NUMBER ON COUPON BELOW

8/46

POWER, 330 West 42nd Street, New York, 18, N. Y.

Please send me....copies of the following reprints circled below. I enclose check ( ) money order ( ) for $.....

1 2 3 4 5 6

Name.....

Address.....

City..... State.....

How Sarco Serves in
2 LSI ELECTRIC CONTROLS
21 TEMPERATURE REGULATORS FOR PROCESSES
5 87C THERMOTON CONTROLS FOR PLATING
85 STRAINERS UP TO 3"
12 DIAL THERMOMETERS
197 FLOAT-THERMOSTATIC STEAM TRAPS ¾ to 2"
7 SCRAPER STRAINERS 1¼ and 1½"
274 BUCKET STEAM-TRAPS ½ to 1¼"
22 RADIATOR VALVES
27 SH 65 RADIATOR TRAPS

THE MODERN FACTORY

Here is a typical case with no name mentioned, because it is a defense plant. The industrial company and their contractor decided to standardize on Sarco for all steam traps and temperature control because in their years of experience in connection with many other jobs, there was no other line as broad and versatile and as reliable.

The illustration above shows the extent to which eight different but related Sarco products were used in this one plant, and the wide range of sizes required. Team work in operation was obviously secured.

Other advantages of standardization with Sarco are:

Ease of inspection and cleaning without disturbing the piping. Small number of spare parts required in stores. Ease of obtaining duplicates for additions or extensions, and the knowledge that all parts were made in one plant by one company.

WHEN YOU PLAN get the Sarco HOOK-UP BOOK which will show you how completely and satisfactorily Sarco products can serve your plant.

FOUR STARS ON OUR E PENNANT TESTIFY TO SARCO PERFORMANCE IN THE WAR EFFORT.

ARMY E NAVY

SARCO SAVES STEAM

Represented in Principal Cities

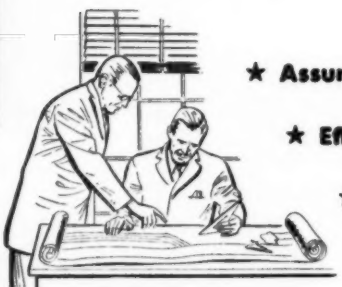
SARCO COMPANY, INC., 475 FIFTH AVE., NEW YORK 17, N.Y. • Sarco Canada, Ltd., 85 Richmond St., W., Toronto 1, Ont.

Operating Cost Savings

ENGINEERED INTO PIPING BY *NAVCO*

Careful and expert preliminary engineering work by Navco Engineers, in addition to employing the most modern fabricating and erection methods, are your guarantee of operating savings.

Consult Navco for just a Pipe Bend, or a complete Piping System.



- ★ Assured Safety
- ★ Efficient Operation
- ★ Minimum Fuel Costs
- ★ Low Maintenance
- ★ Long Trouble-Free Life

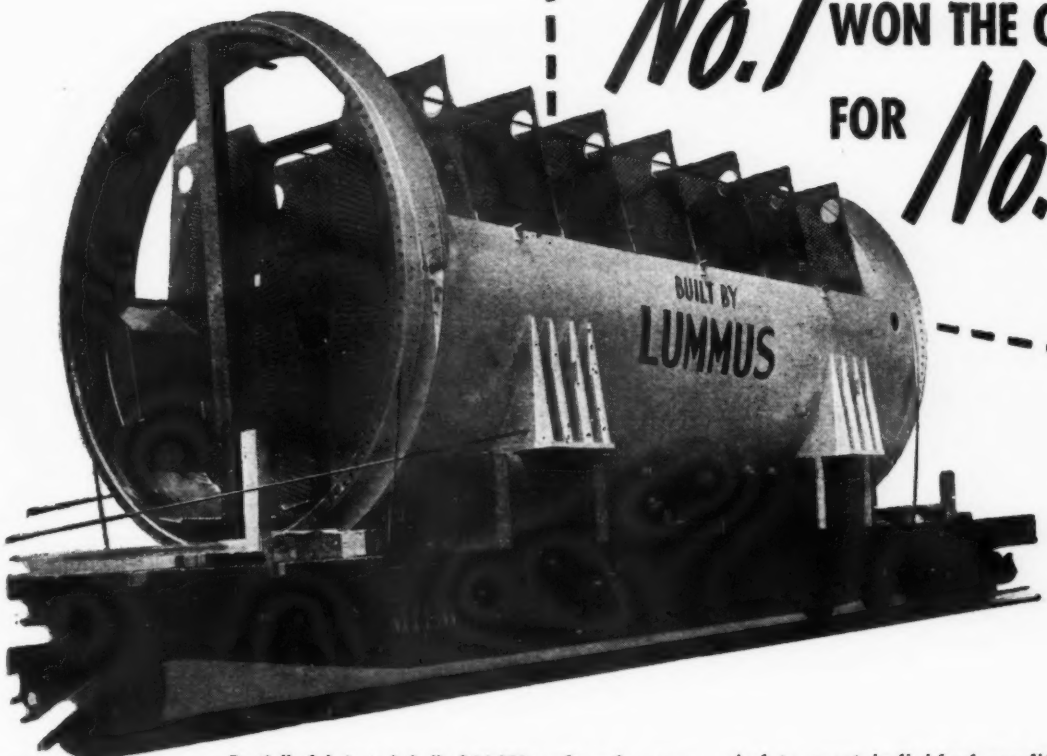
NAVCO

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

No. 1 WON THE ORDER FOR No. 2



Partially fabricated shell of 36,000 sq. ft. surface condenser. The second of two supplied—complete with air ejector and all appurtenances—to a prominent utility

LUMMUS EQUIPMENT

- HEAT EXCHANGERS
- PROCESS CONDENSERS
- REBOILERS
- STEAM GENERATORS
- STEAM JET REFRIGERATION
- STEAM SURFACE CONDENSERS
- BAROMETRIC CONDENSERS
- STEAM JET AIR EJECTORS
- EVAPORATORS
- BOILER BLOWDOWN HEAT EXCHANGERS
- FUEL OIL HEATERS
- LUBRICATING OIL COOLERS
- PIPE LINE COOLERS
- FEED WATER HEATERS
- JACKET WATER COOLERS

FIVE YEARS AGO, Lummus designed and built a 36,000 sq. ft. surface condenser for a well known public utility plant. So satisfactorily has this unit performed that the utility recently ordered an exact duplicate with air ejector and appurtenances—an indication of the satisfaction *you* can expect from Lummus power-plant equipment.

LUMMUS CONDENSER FEATURES

Lummus' distinctive tube sheet layouts, varied to meet individual conditions, provide large internal steam space with an open steam lane through the center of the condenser. Lummus Surface Condensers are designed for full deaeration by cascading the condensate through live steam. This arrangement serves to prevent condensate depression even at low loads, as well as to remove the soluble air.

Lummus designs and builds a complete line of surface condensers and other heat-exchange equipment for stationary and petroleum-refinery applications. Write for full information.

THE LUMMUS COMPANY
420 LEXINGTON AVE., NEW YORK 17, N. Y.

Lummus
HEAT EXCHANGER DIVISION

For ease of bending, welding... and for long service—

USE J&L SEAMLESS PIPE

The J&L Controlled Quality steel in J&L steel pipe provides a pipe especially well adapted for power plant installations. In its bending and welding qualities, uniform wall thickness, straightness and inherent strength you have all the properties that make for exacting installations and long and satisfactory service life. Write for further information.

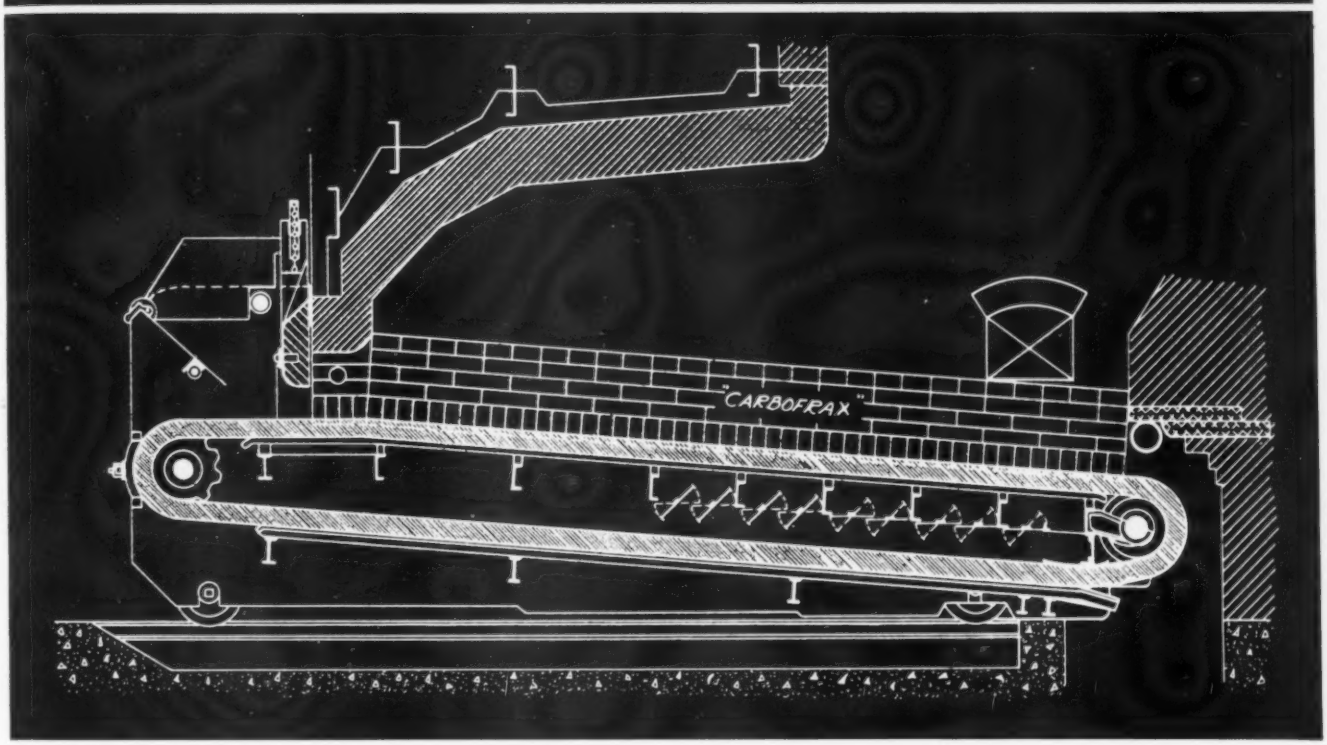
JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

WALL BRICK DATA

LACLEDE Natural Draft STOKER

Prevent Clinkers from hampering Furnace Efficiency



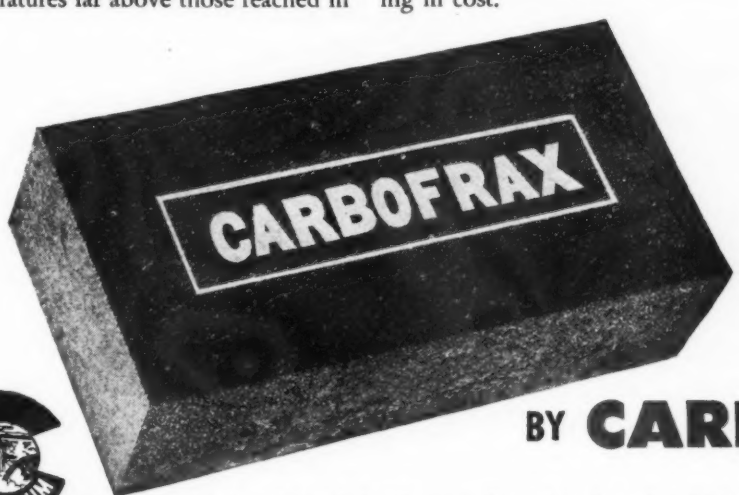
The efficient performance of a Laclede Stoker is greatly improved by using CARBOFRAX silicon carbide brick in the boiler walls. A typical installation is shown by the illustration.

Trouble causing, space consuming clinkers cannot form on the dense surface of CARBOFRAX brick. These brick remain hard and impenetrable at temperatures far above those reached in normal operation. With no softening of the brickwork, the moving fuel bed helps to clean the walls. Any accumulations remaining are easily barred off.

Unrestricted by choking clinker formations, the fire is active over the entire grate area. Fuel is burned more efficiently . . . more economically. Greater furnace capacity is realized with a decided saving in cost.

Production is uninterrupted by the frequent repairs usually experienced when ordinary refractories are used. The resistance of CARBOFRAX brick to mechanical abrasion, spalling and cracking is particularly noteworthy. Reports from the field of steady service from 8 to 10 years are not exceptional. And since CARBOFRAX brick do not burn or cut back, upper walls do not require the repair and maintenance otherwise expected.

A thorough investigation of the advantages provided by CARBOFRAX settings often leads to beneficial results. Engineering details can be quickly and easily found in our specially prepared booklet "CARBOFRAX in Boiler Furnaces." Write Dept. G-86 for your copy today. The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.



BY **CARBORUNDUM**
TRADE MARK

"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

BARTLETT-SNOW WEIGH LARRIES

OFFER 5 OUTSTANDING ADVANTAGES

● **A WEIGH LARRY COSTS LESS:**—than fixed chutes each fitted with necessary cut-off gates, scales, etc., when four or more boilers are to be served from a suspension bunker.

WEIGH LARRIES WEIGH THE COAL:—and permit an accurate card record to be kept of the coal consumption and operating efficiency of each boiler.

WEIGH LARRIES ELIMINATE SEGREGATION:—and produce an even dispersion of lumps and fines in the stoker hopper, resulting in ideal draft and burning conditions.

SIMPLIFIED BUILDING:—Weigh larries permit the use—if desired—of a cylindrical bunker located at the end of the building,—eliminating the massive and costly structural supports needed for suspension bunkers, and the necessity of placing machinery, controls, etc., in front of the boilers,—thus assuring easy access to the boilers for repairs,—and ample light and ventilation.

PROVEN CONSTRUCTION:—Hand propelled and motor-driven,—floor and cage-operated types, having capacities from ½ ton to 2 tons per load are standard. Special types to meet any requirements. All reflect the advantage of Bartlett-Snow's exacting design, and skillful painstaking manufacture.

Bulletin No. 83 gives full details and contains much information of interest to engineers and operating men. Send for a copy.

THE C. O. BARTLETT & SNOW CO.

6205 HARVARD AVENUE • CLEVELAND 5, OHIO

Engineering and Sales Representatives in Principal Cities

COAL HANDLING FOR CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS

TRACK HOPPERS • SKIP HOISTS • BUCKET ELEVATORS • BELT CONVEYORS
BINS AND BUNKERS • WEIGH LARRIES • FIELD STORAGE • ASH HANDLING

Where "STAYING POWER" *Counts!*

"Buffalo" DRAFT FANS *Serve Longer*

THESE BOOKLETS CAN HELP YOU!

Complete details on lowering draft fan maintenance the "Buffalo" way are *yours for the writing.*

For *Forced Draft Fan* facts, specify Bulletin 3113.

For *Induced Draft* Fans, write for Bulletin 3190-B.

Besides delivering maximum air at least power cost, forced and induced draft fans must possess a high degree of DURABILITY for the endless, punishing task of keeping vital fires at top efficiency.

"Buffalo" Forced and Induced Draft Fans are engineered with extra-heavy rotors, perfectly balanced for smooth running and hot-riveted for enduring rigidity . . . extra husky housings that can absorb the constant beating of years, and may be quickly disassembled and replaced when necessary.

These "Buffalo" fans have earned a low-maintenance, high-delivery reputation in many installations, large and small. It will pay you to consult your nearest "Buffalo" representative for recommendations.

BUFFALO FORGE COMPANY

488 Broadway **Buffalo, N. Y.**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

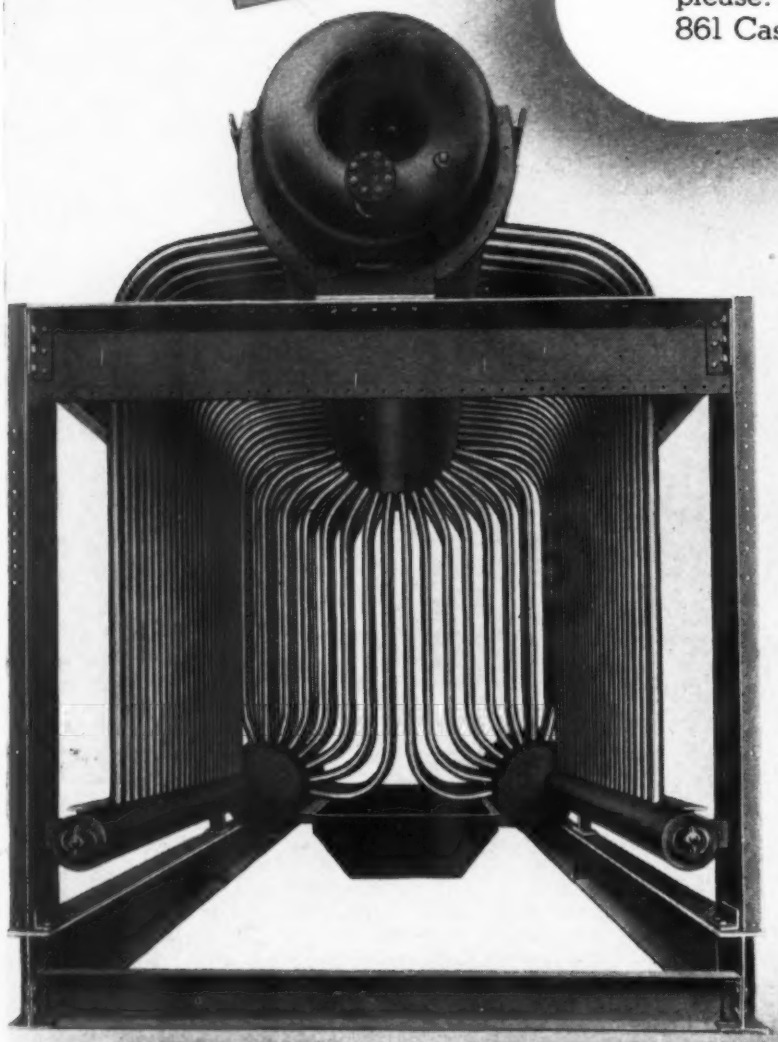
"Buffalo"

Forged and Induced

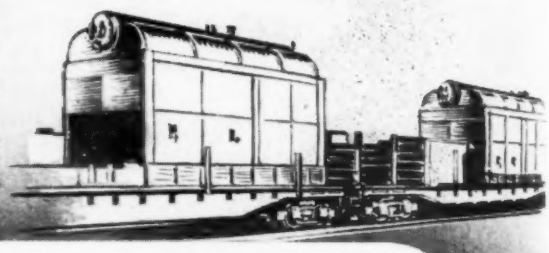
Draft Fans

UNION OFFERS *New* BOOKLET ON *New* BOILER DESIGN

We have prepared a book illustrating the construction of our latest boiler development, the "S" type boiler. Complete engineering data is included. Request your copy of this booklet on company letterhead, please. Address Union Iron Works, 861 Cascade St., Erie, Pa.



The UNION "S" type boiler is a compact selfcontained boiler--water cooled furnace unit. It can be shipped fully assembled in sizes to 300 H .P. It has narrow overhall width and provides a large furnace volume in a low setting height which provides high capacity in limited space. You will be interested in how we have provided water wall circulation without circulator connections and in many other unusual design features.



UNION IRON WORKS • ERIE, PA.

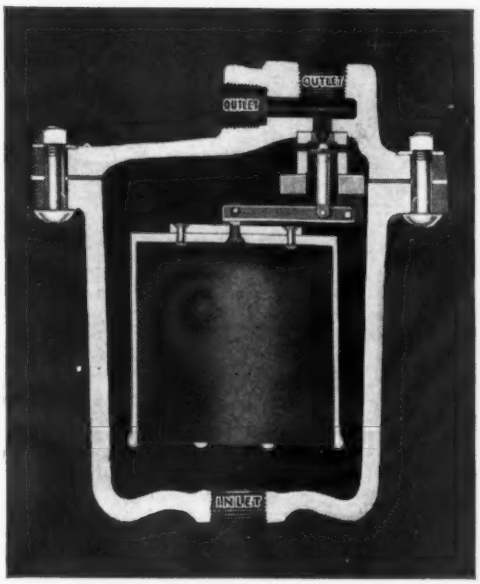
Since 1890

BOILERS — PROCESS EQUIPMENT — FABRICATED STEEL

Fuel Savings

Clark Steam Traps *save fuel* by removing condensate and air from steam lines and by preventing steam leakage . . . At the same time they make equipment more efficient and prolong equipment life . . . That's why, for

38 YEARS . . wherever steam, air and gas are used . . Clark Fluid Controls have paid for themselves quickly, and returned worthwhile profits throughout their long service life. They will do it for *you.*



The popular CLARK SERIES 80 Inverted Bucket Type Steam Traps with Clark Patented Bucket Venting Device and other exclusive Clark features. Available in 6 sizes, ½" to 2½", for pressures up to 250 P.S.I. and temperatures to 450°F. Write for free catalog for complete specifications and applications of the wide line of Clark Fluid Controls.

Clark
FLUID CONTROLS

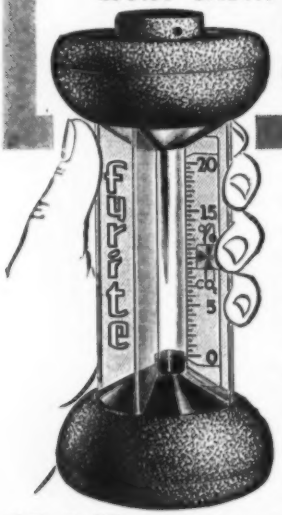
THE CLARK MANUFACTURING COMPANY · DEPT. A · CLEVELAND 14, OHIO

Makers of a wide line of fluid controls including

STEAM AND FLUID TRAPS	STRAINERS	PRESSURE REGULATORS
VACUUM AND LIFTING TRAPS	VALVES	REDUCING VALVES

DETECT FUEL WASTE IN 40 SECONDS

with the... **FYRITE CO_2 INDICATOR**



The FYRITE makes accurate CO_2 analysis of the flue gases easy—and CO_2 percentage is the direct index of fuel wasted up the stack due to needless excess air being drawn into the furnace. The FYRITE is sturdy, spill-proof—accurate within ½ of 1% CO_2. No setting-up necessary; no valves, clamps, or leveling bottle. More than 13,000 are in successful use.

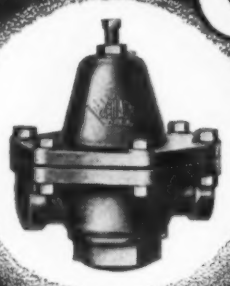
Send for Bulletin 703

$24.00 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

BACHARACH
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH 8, PA

Also Available!
OXYGEN INDICATOR
for DIRECT Oxygen Analysis
Employs FYRITE principle . . . accuracy not affected by temperature and atmospheric conditions, or by presence of other gas in sample.
Ask for Leaflet 700

PRESSURE *Control*



has for years been a PROBLEM IN INDUSTRY

Designing Engineers and Maintenance men alike want a valve that is Accurate, Dependable, Easily repaired ON THE JOB, and not too Complicated or Bulky.

EIGHTEEN YEARS AGO CASH-ACME Engineers, realizing this, developed the Type "B", a Direct-acting, Single-seated Pressure Reducing and Regulating Valve.

Since that time thousands of installations in hundreds of different applications have more than indicated the Type "B" has fulfilled industry's requirements.

In Automatic VALVES *as* THIS *name that counts*

Write today for YOUR copy of our 28 page Catalog describing how CASH-ACME products can best serve you.

CASH-ACME A.W. CASH VALVE MFG. CORP.
6662 EAST WABASH AVE.
DECATUR ILLINOIS

PEERLESS CENTRIFUGAL PUMPS

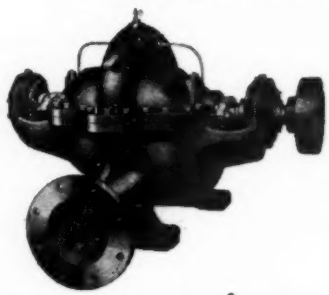
(FORMERLY DAYTON-DOWD)

FOR INDUSTRIAL USES

PEERLESS PUMPS

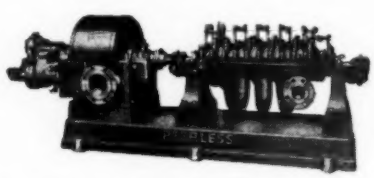
CAPACITIES TO 60,000 G.P.M.
A COMPLETE RANGE OF SIZES AND TYPES

PEERLESS TYPE "A"
FOR GENERAL PURPOSE PUMPING



Split Case; Single-stage; double suction; sizes: from 8" to 42"; capacities: up to 60,000 g.p.m.

PEERLESS BOILER FEED TYPE "B" PUMP



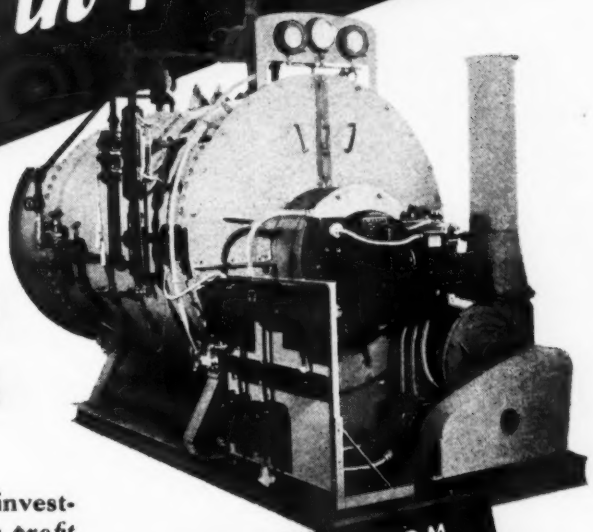
Designed particularly for bolier feed, oil refinery and pipe line service. Pressure: to 700 lbs.; sizes: 2½", 3" and 4". Multi-stage, automatically balanced type.

Peerless Centrifugal pumps are adapted for use in a wide variety of services including municipal, paper mill, sugar mill, mining, filtration, irrigation, chemical processing, food and refrigeration uses. Descriptive engineering bulletins available.

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
Canton 6, Ohio • Quincy, Illinois • Los Angeles 31, California
DISTRIBUTORS IN ALL PRINCIPAL CITIES

There's PROFIT in POWER

by PREFERRED
UNIT STEAM GENERATORS



YOUR power plant can really be a *powerful* investment. Efficient steam generation can bring you *profit through savings* which are often greater than those derived from other economy measures.

The Preferred Unit Steam Generator is a sure way of getting the most profit through savings from reduced steam costs. Its 80% thermal efficiency, compared to the 60-65% efficiency of units developed as recently as 15 years ago, can lower steam costs some 25%. If your production budget is cut "fine" this may mean a profit increase of as much as 40%.

Here is why modern design, engineering and construction features of the Preferred Unit Steam Generator make possible maximum performance values . . . at minimum operating costs:

Pull-through draft controls air volume . . . provides the exact amount of air needed for perfect combustion. This induced draft fan control requires just a vent to outside air. There is no stack to build and no danger of combustion products being forced into the boiler room.

Preferred Unit Steam Generators are equipped to burn light oil up to 100 H.P. and heavy fuel oil up to 500 H.P. fully automatically.

Specially designed burners in the Preferred Unit Steam Generator assure low refractory maintenance.

The Preferred Unit Steam Generator is available in a full range of sizes . . . up to 500 H.P., either low pressure or pressures up to 200 lbs.

Your power plant can operate *more* economically . . . *more* efficiently with a Preferred Unit Steam Generator. Profit by our 25 years of combustion "know-how."

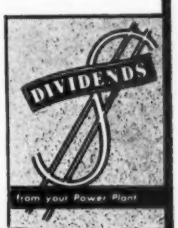
PREFERRED UTILITIES MANUFACTURING CORPORATION
1860 Broadway, New York 23, N. Y.

PR-123

"DIVIDENDS FROM YOUR POWER PLANT"

You can help management to understand your responsibilities . . . and to realize the profit generating features of efficient power plant operation. Show them this new, informative booklet in which the problems of power generation are fully discussed . . . and authoritatively answered. It contains ten concise articles which are written in clear, simple terms so that non-technical executives can quickly grasp their import. "The Engineer is a Gold Mine" is one of the leading articles . . . and the entire booklet may prove to be quite a "gold mine" for you.

As soon as you return this coupon we'll send out your copy of "Dividends From Your Power Plant," together with our bulletin #1000.



SIGN AND MAIL TODAY

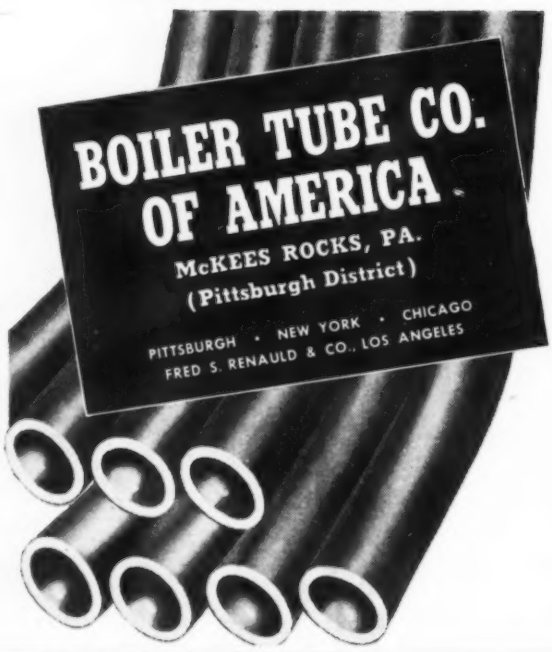
PREFERRED UTILITIES MFG. CORP.
1860 Broadway, New York 23, New York

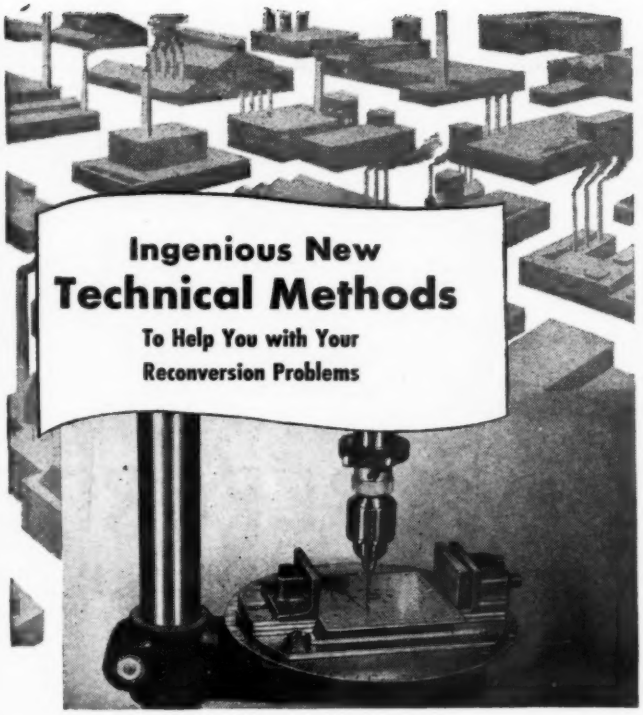
Please send me FREE and without obligation, bulletin #1000 and the ten articles in booklet form, titled—"Dividends From Your Power Plant."

Name .....
Company Name .....
P-8-46 .....
Street .....
City .....
State .....

PREFERRED UTILITIES

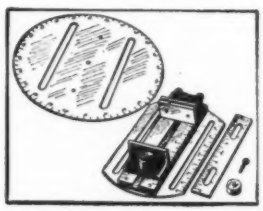
"The World's Fastest Complete Boiler Tube Service"





New, Simplified Drill Press Vise, Speeds Up Drilling, Spacing, Milling

Designed to be used with a drill press table having either parallel or radial slots, the New UNI-VISE drill press vise, with guide bar and protractor disc, speeds up and simplifies drilling, layout and spacing work in straight lines, radial or circular. With two movable jaws, vise has universal movement without swinging table or head of drill press to locate exact position of work. Operator thus adjusts work quickly for accurate registration.



Guide Bar facilitates drilling holes in a straight line. With a straight edge and a lineal scale on surface, it registers with lineal scale of vise. Protractor disc, for drilling holes accurately in a circle, has parallel slots registering with parallel slots in base of vise, and a removable means to pivot complete unit on table of drill press.

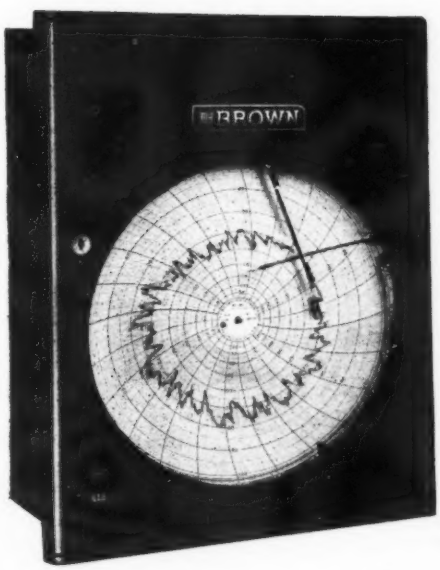
Accurate work can always best be done by attentive operators. That's why many factories urge workers to chew gum. The chewing action helps relieve monotony—helps keep workers alert, thus aiding them to do a better job with greater ease and safety. And workers can chew Wrigley's Spearmint Gum right on the job—even when hands are busy.

You can get complete information from Spiral Mfg. Corp., 3612-26 N. Kilbourn Ave., Chicago 41, Ill.

AA-84

grasp these savings

in FUEL DOLLARS !



Brown Electric Recording Integrating Flow Meter

By elimination of needless waste in steam distribution, fuel dollars can be saved. Grasp these savings through the use of Brown Totalizing Flow Meters.

Brown Flow Meters' permanent two-fold records make possible dual savings. The *record line* shows rate of flow . . . enabling you to analyze steam usage . . . while the *automatic planimeter* pen shows consumption . . . simplifying cost accounting.

Permanent records are the needed incentive to eliminate wasteful steam usage. Brown Totalizing Flow Meters are effecting substantial fuel savings for thousands of steam engineers and have saved installation costs many times over.

Available in seven interchangeable range tubes, their capacity can be quickly altered to suit production conditions. It is seldom necessary to change the orifice. Models furnished for pressures up to 2500 lbs.

Write for catalog. THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4490 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities. Toronto, Canada; London, England; Stockholm, Sweden; Amsterdam, Holland.

BROWN FLOW METERS

. . . MINNEAPOLIS - HONEYWELL CONTROL SYSTEMS . . .

This Baby is TOUGH!

Airetool Tube Cleaners Crack-Down on Scale

Airetool Tube Cleaners and Expanders have the "guts" of champions . . . they take it on the chin and keep boring in . . . they don't stop!

Airetool engineers know that there is no place for a tool that must be pampered. They know that in the power industry, or in any other highly competitive industrial field, it's results that count, it's the ability to take rough and tumble handling and come up with a precision job that pays off.

So Airetool cleaners and expanders are *tough babies* . . . yet they retain split hair precision. Airetool Cleaners keep tubes at a high efficiency level and Airetool expanders roll out joints in a smooth perfection that high pressures and temperatures demand.

There is an Airetool Cleaner and Expander for every job you have. Cleaners with either the cutter or brush head types are available for curved and straight tubes in sizes from ½" to 24" I.D. Airetool expanders are made in sizes from ½" to 12" I.D.

Write Airetool Manufacturing Co., Dept. P, Springfield, Ohio for further information and informative booklets.

AIRETOOL MANUFACTURING COMPANY

Prevent Motor BREAKDOWNS *that cause Plant* SHUTDOWNS!

IDEAL MOTOR MAINTENANCE EQUIPMENT

New motors are still scarce; conserve the ones you have.

When Commutators and Slip Rings show signs of wear, when spitting and burning indicate high mica, etc., a few minutes use of IDEAL Motor Maintenance Equipment will restore original high efficiency. IDEAL Tools used periodically keep Commutators and Slip Rings "good as new" and prevent costly shutdowns.

❶ **RESURFACERS** (Hand Type) Remove pin ridges, roughness and small flat spots from Commutators and Slip Rings, while the armature rotates in its own bearings.

❷ **PRECISION GRINDERS** (with Tool Type Resurfacers) Restore surfaces that are badly scored and out-of-round. Easy to mount right on motor frame. No dismantling necessary.

❸ **MICA UNDERCUTTERS** (Power Driven) Undercut hardest mica, without taking down motor or generator.

OTHER IDEAL Motor Maintenance Equipment —Carbon Brush Seater, Commutator Cleaning Stone, Commutator Saws and Milling Cutters, Slotting Files, Hand Type Slotter and Scraper, etc.

Motor Equipment Division

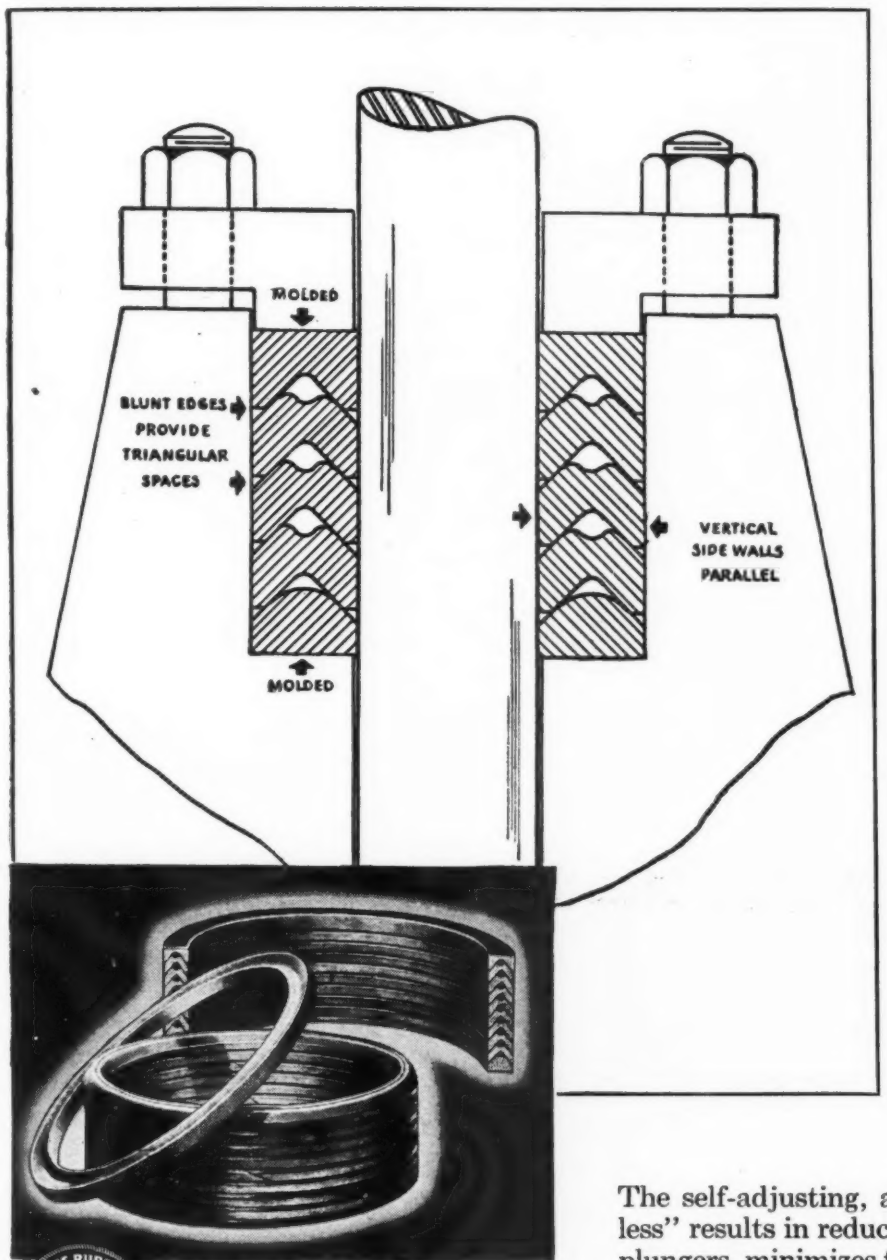
1753

IDEAL INDUSTRIES, Inc. *(Successor to Ideal Commutator Dresser Co.)*

1025 PARK AVENUE — SYCAMORE, ILLINOIS

SERVING YOU THROUGH SCIENCE

Longer Life FOR RODS AND PLUNGERS WITH UNIQUE U.S. MATCHLESS PACKINGS



No Other Packing Has All These Advantages

BLUNT EDGES—Give more efficient shape; allow fabric to reach end of packing, providing uniform strength throughout. In conventional packing (feather-edge design) fabric cannot be forced into sharp edge, leaving unprotected soft-rubber end to cause curling and chipping.

TRIANGULAR SPACES—Blunt edges provide triangular spaces for trapping loose scale, oil, etc. Result is less friction, less power required, and scaling does not score entire length of packing set.

PRESSURE BREAK—The triangular space of each ring breaks the pressure more quickly than ordinary types without this feature. With "Matchless" design, automatic action is faster, more effective.

MOLDED END RINGS—Tests show the female ring and the one next to it take 70% of the pressure on the set. In "Matchless" *all* rings are molded, are of proper density, and have no sharp edges to break off, as on end rings cut from slab.

EASY TO INSTALL—Matchless Packing has parallel side walls, while conventional packings are made with varying degrees of wall flare. "Matchless" rings slide easily into stuffing box; the flare type requires considerable effort and time.

The self-adjusting, automatic action of "Matchless" results in reduced wear and tear on rods and plungers, minimizes friction and keeps down packing costs. For hydraulic equipment, presses, rams, triplex pumps, outside packed pumps, and swivels on rotary drilling rigs. Write for details.

UNITED STATES RUBBER COMPANY

1230 Avenue of the Americas • Rockefeller Center • New York 20, N. Y.

HOPPES

FEEDWATER HEATERS

Deaerating and Non-Deaerating

Write for Bulletin

THE HOPPES MFG. CO.

Established 1881

SPRINGFIELD OHIO

YOU'RE ALWAYS SURE With A LIQUIDOMETER Tank Gauge

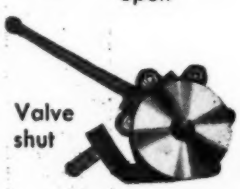
WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE LIQUIDOMETER CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, L.N.Y.

The Danger Line ... but

Valve open and locked open



Valve shut

No matter WHAT happens on this boiler water-column line — this plant will not be shut down for repairs. Nor will the boiler-room crew be exposed to any danger while repairs are made.

These EVERLASTING water-column valves *keep your boilers going* . . . keep connections to water-column free from clogging . . . permit replacement of broken gage glasses . . . allow repairs to try-cocks and gage-cocks — without danger of your men being scalded while repairs are made.

Shut these EVERLASTING valves with a quick, easy short-stroke push on the lever—and you have a drop-tight seal. No need to protect face and hands from leaking steam or water—*there is none!* No need to reduce steam-pressure or unduly hurry repairs—*your men are SAFE!*

After repairs are completed . . . open these EVERLASTING valves . . . and seal the levers open. The valve indicators always show clearly which position the valves are in. And when they're open, these valves provide a straight-through unimpeded flow that *prevents* clogging.

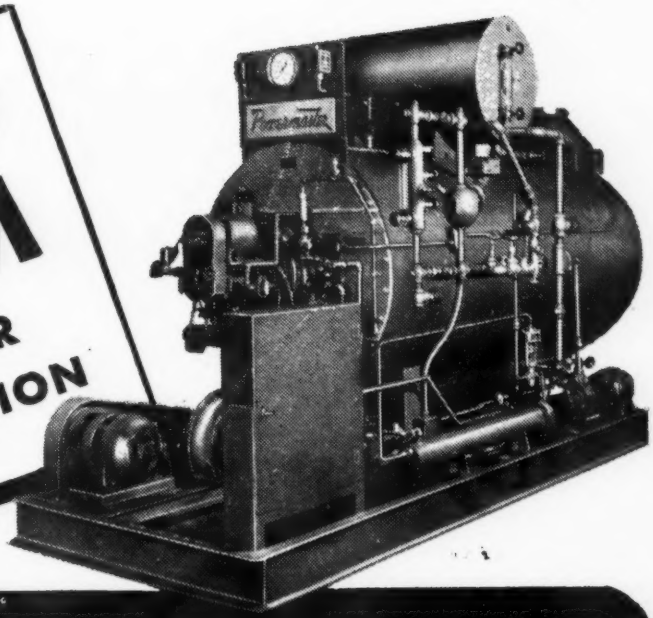
EVERLASTING water-column valves meet all A.S.M.E. code specifications—*plus!* They have always been preferred by experienced engineers because they have proven safest on thousands upon thousands of installations. Write today for Bulletin on these valves and our complete line of blow-off valves. EV-276

EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N.J.

Everlasting Valves

FOR EVERLASTING PROTECTION

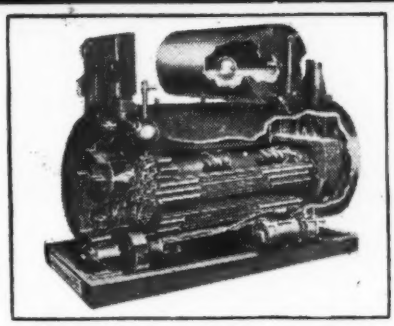
FAST LOW-COST STEAM WITH LIGHT OIL OR HEAVY OIL OPERATION



O&S Powermaster

THE AUTOMATIC "PACKAGED" STEAM GENERATOR

IT'S ALL IN THE ENGINEERING



Some of the Powermaster's advantages are clearly shown by a "cut-away" view which discloses its efficient, cost-saving 3-pass design:

1. *COMPLETELY AUTOMATIC* — All controls for automatic operation on convenient panel—unit starts with a flick of the switch and operates without manual attention.

2. *CONDENSATE RETURN SYSTEM*—Compactly mounted as integral part of unit; maintains water level and feeds make-up water automatically.

3. *OIL BURNER* — Especially designed by O&S engineers for light or heavy oil operation and built for maximum heat with less fuel.

4. *ROTARY FLAME* — The Powermaster's "spinning flame" results in highest heat transfer utilizing all possible B. T. U.'s.

5. *FORCED DRAFT OPERATION* —A stack is not needed for draft and heat is retained *inside* boiler; only a small vent pipe is required to carry flue gases outside.

60 YEARS of boiler engineering and manufacture are behind the new O&S Powermaster Unit. Boiler—oil burner—condensate return and control systems are combined in one compact steam plant. Tested to A. S. M. E. standards, shipped complete and installed in a few hours. Descriptive bulletin will be mailed without obligation —please send coupon below.

ORR & SEMBOWER INC.

READING, PENNSYLVANIA

District Offices: BOSTON · CHICAGO · CLEVELAND · NEW YORK · PHILADELPHIA · SEATTLE

ORR & SEMBOWER, INC.
892 MORGANTOWN ROAD
READING, PENNSYLVANIA

Please mail the new 8-page O & S Powermaster Bulletin #1214, without obligation, to:

COMPANY_____

ADDRESS_____

CITY_____ ZONE #_____ STATE_____

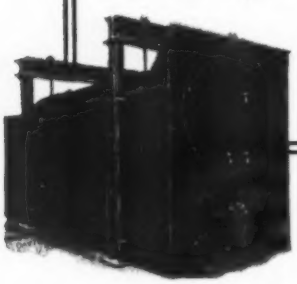
ATTENTION OF_____

OLD BOILER STILL PERKY IN ALBUQUERQUE!

"All the original flues are still in it, and there are no signs of leaks," writes an Albuquerque (New Mexico) laundryman about a Brownell 80 hp. H.R.T. Boiler which has been in constant operation since 1928.

Though this boiler would be good for many more years, the laundry has outgrown it. So, the present requirement is a Brownell H.R.T. 150-hp. boiler.

This is an example of customer satisfaction. Much of our business consists of reorders from satisfied customers — and we've acquired a lot of them during our 91 years of building boilers, stokers, and water heaters.



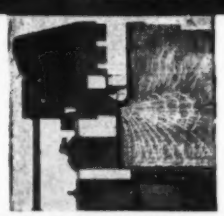
Brownell Horizontal Return Tubular Boiler with steel casing; capacities of 20 to 250 hp. One of the nine types of Brownell Boilers.

THE **BROWNELL** COMPANY
306 N. FINDLAY ST.
DAYTON 1, OHIO

FYR-FEEDER MULTIPLE SPREADER STOKERS

Available Now!

FEATURING:



AIR JET COAL PROPULSION

• **FYR-FEEDER pays for itself in coal and labor savings.** • **Automatic, modern, high efficiency firing at its best!** • **Increases boiler capacity with cheapest grades of coal — screenings or sweepings, wet or dry. CUTS FUEL BILLS!** • **Easy to operate. Responds instantly to sudden load changes. Burns fines in suspension; larger pieces on grate. Beautifully clean flame.** • **Safe. Dependable. Multiple Burners. Quality construction.** • **Easily installed in minimum time. Standard ratings from 100 to 12,000 lbs. of coal per hour. Wire, phone, or write.**

FYR-FEEDER *Multiple* SPREADER STOKER
IT'S EFFICIENT
IT'S AUTOMATIC
PAYS FOR ITSELF

FYR-FEEDER INDUSTRIAL STOKERS
18-R E. Erie St., Chicago 11, Illinois

- ☐ Interested in FYR-FEEDER Dealership
- ☐ Interested as Sales Representative
- ☐ Send literature and delivery information
- ☐ Have representative call

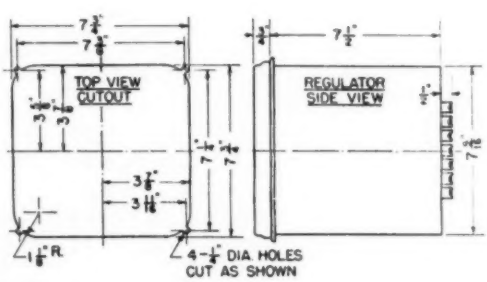
Name_____
Company_____
Address_____

Burlington Synchrostat
(REG U S PAT OFF)

VOLTAGE REGULATOR

Type SR Model SF has a sensitivity of ±2% and is designed to regulate the A.C. voltage of engine generator sets up to 100 K.V.A. 50-60 cycles dependent upon exciter characteristics. Maximum rating of vibrating contacts is 2 amperes at 125 volts.

Inquiries for complete information and engineering service are solicited.

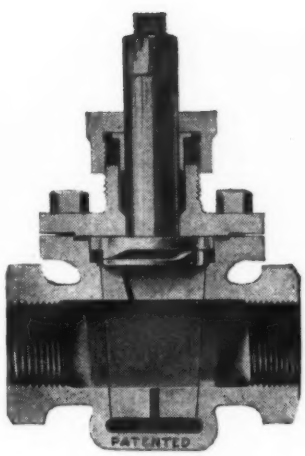


BURLINGTON INSTRUMENT CO.
708 FOURTH STREET **BURLINGTON, IOWA**

FULL FLOW OR DROP-TIGHT SHUT OFF

A Quarter-Turn Does It!

16 to 28 Times Faster
Than Screw-Stem-Type Valves.



Sectional View (Open Position) Showing Protected Seating Surfaces, Straight-Line Fluid Flow and Rugged Valve Construction.

For quick, positive control in the handling of air, water, gas, oil and other fluids, HOMESTEAD QUARTER-TURN VALVES are unsurpassed. They act quickly and positively because a simple quarter-turn fully opens or closes the valve, and the patented Homestead cam holds seating surfaces in contact at all times, yet permits easy turning.

When the operating handle is moved to the *closed position,* the cam surfaces come into contact automatically, thus pressing seating surfaces together to form a "drop-tight" seal. When the handle is turned to the *open position,* pressure on the cam surfaces is relieved, permitting the plug to turn freely through 90 degrees to a positive stop in the full-open position.

Straight, unobstructed fluid passage, assures "full flow" and minimum drop in line pressure. And because seating surfaces are protected in both open and closed positions, corrosive fluids and grit cannot damage or cause valve failure. Add to these important features the rugged construction characteristic of all HOMESTEAD VALVES and you have the reason why hundreds of users in all types of industry specify HOMESTEAD QUARTER-TURN VALVES for long, trouble-free, low cost service.

HOMESTEAD QUARTER-TURN VALVES are made in sizes, types and metals for most of your valve needs; for pressures to 3000 pounds and temperatures to 750 degrees F. Our engineering department will design special valves to your own specifications. Write for Valve Reference Book No. 38.

HOMESTEAD VALVE MFG. CO.

P. O. BOX 210 **CORAOPOLIS, PENNSYLVANIA**

BATES • GRATES

for better open steel flooring and stair treads

The glow from the open furnace door below the grating illustrates the maximum light, ventilation and the ease of maintenance that goes with BATES • GRATES. *Normal cleaning routine keeps the floors in new-floor condition — clean and safe.*

●

Up the stairs or along the walkways, BATES • GRATES *are safer, stronger, more durable.*

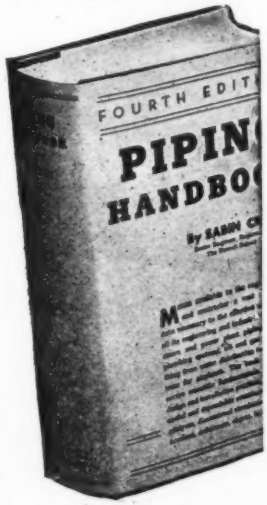
THESE are the features you want in open steel flooring and stair treads: Strength, safety, ease of maintenance, durability, good underfloor lighting and maximum ventilation.

You get all six to the limit when you install BATES • GRATES. The simple directness of BATES • GRATES engineering — with Hex cross bars fillet-welded to main bars—makes this possible.

You don't pay for BATES • GRATES quality . . . It pays you.

Complete, comprehensive guide to piping design and application

—The data and methods you need for solving every piping problem



HERE is an indispensable tool for the engineer, contractor, and designer, the famous PIPING HANDBOOK — now available in an up-to-date, fully revised, enlarged Fourth Edition. This vast compilation of data and methods for most effective use of piping puts at your fingertips all the principles that influence the design, construction and use of piping systems. *Any* fact, on any phase of piping practice, is here in clear, dependable, accessible form.

PIPING HANDBOOK

Revised, enlarged, up-to-date Fourth EDITION

By SABIN CROCKER

Senior Engineer, Engineering Division, The Detroit Edison Company

1376 pages, 4½ x 7½, 334 illustrations, 329 tables, $7.50

THIS vast handbook covering the fundamentals, materials, and techniques of modern piping practice is now enlarged by 500 pages, including four new chapters in line with the increasing importance of piping systems in industrial operations, with tables and charts, abstracts, standards, etc. revised and improved, and scores of new facts and figures added. Now more than ever the PIPING HANDBOOK is an invaluable self-contained key to effective piping practice.

Completely covers piping practice in these major fields

Steam Power-plant Piping
Building Heating
Plumbing
Underground Steam Piping
Water-supply Piping
Fire-protection Piping
Oil and Refinery Piping
Gas Manufacture and Distribution
Refrigeration
Hydraulic Power Transmission

See it 10 days—FREE!

SEND THIS McGRAW-HILL COUPON

McGRAW-HILL ON-APPROVAL COUPON

McGraw-Hill Book Co., 330 W. 42nd St., New York 18.

Send me Crocker's **PIPING HANDBOOK** for ten days' examination on approval. In 10 days I will send $7.50, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

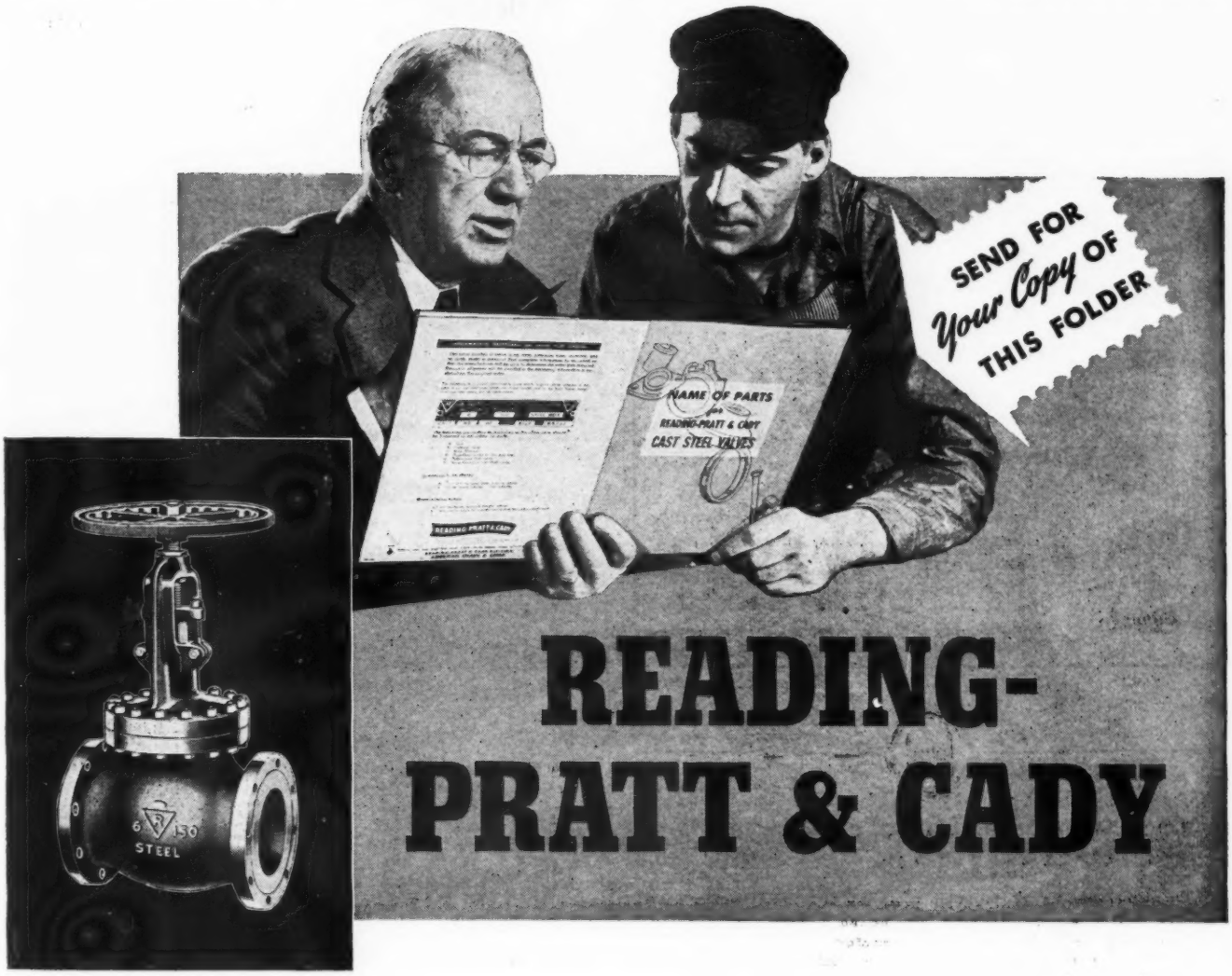
City and State .....

Company .....

Position ..... P. 8-46

(For Canadian price, write Embassy Book Co., 12 Richmond St. E., Toronto 1.)

This Simplifies Ordering STEEL VALVES and PARTS



This six-page, file-size folder contains much useful information in convenient form. Here are the standard names of all component parts of steel gate, globe and check valves. Cut-away pictures make it a very simple matter to identify each part. Send for your copy.

Reading-Pratt & Cady distributors are located in principal cities.

Reading Cast Steel Valves and Fittings • Pratt & Cady Brass and Iron Valves
d'Este Automatic Regulating Valves

ACCO

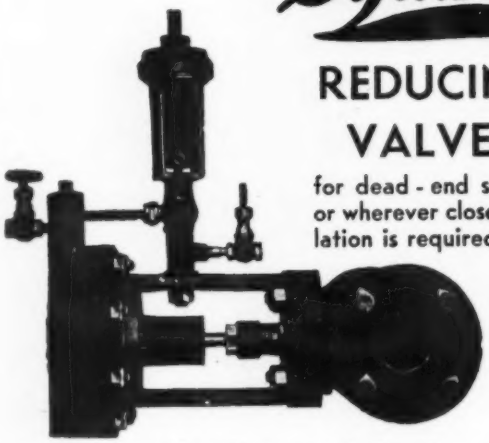
Reading, Pa. • Atlanta • Chicago • Denver • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • Portland, Ore. • San Francisco • Bridgeport Conn.

TRADE MARK

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

Use

THE GENUINE Squires



REDUCING VALVES

for dead - end service, or wherever close regulation is required.

Also Steam and Air Traps, Pump Governors and Boiler Feed Water Controllers.

THE C. E. SQUIRES CO.

E. 40th St. and Kelley Ave. Cleveland, O.

PIPE-LINE or PNEUMATIC CONVEYORS for ASHES and FLY-ASH

"Most economical in steam-consumption and maintenance." Design of every part, fitting, etc., based on our experience of 25 years with the successful manufacture and operation of this type of conveyors and on our full appreciation of their special requirements.

We also specialize in improving existing conveyors through our superior fittings and frequently through rearrangement of present layouts.

CAST IRON SECTIONAL ASH TANKS, COAL BUNKERS, BINS, HOPPERS and SILOS

Durability combined with our exclusive discharge-efficient and self-clearing designs, proventing arching, packing and spontaneous combustion in case of coal bunkers and also obviating the necessity of hazardous trimming.

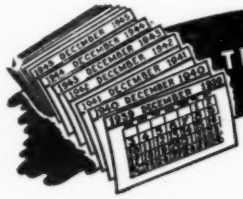
MECHANICAL SOOT BLOWERS for FIRE-TUBE BOILERS of ALL TYPES

Fixed nozzle centered to each tube. No cutting of tube-sheet. No moving parts in hot boiler. All tubes in boiler blown with four successive puffs of steam or air in about one minute. Perfect soot-removal from each tube END TO END.

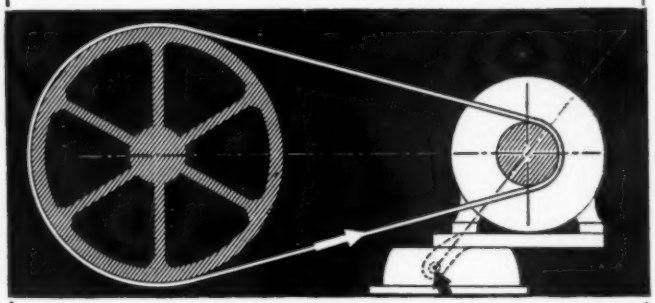
HAHN EQUIPMENT CORPORATION

(Formerly Hahn Engineering Company)

30 Church Street, New York 7, N. Y.



7 YEARS OF CONTINUOUS SERVICE WITHOUT STOPPING . . . Except for Christmas Day . . . reports a big TANNATE-ROCKWOOD user.



TANNATE ROCKWOOD DRIVES Can Help You Too!

TANNATE flat belt short center drives assure correct belt tension—regardless of load, centers or unusual conditions, the weight of the motor maintains proper tension at all times. This means longer service life for your equipment.

The TANNATE flat leather belt has a very high coefficient of friction and great pliability that helps keep machines running at top speed. It is treated to resist moisture, oil and weak acids. TANNATE has unusually high tensile strength which contributes toward increased service life and reduced maintenance expense.

Motor base, one or both pulleys and belt are supplied by Rhoads. Designed to work together, they give superior performance. Maximum speed is maintained, and driven machine capacity is often increased when TANNATE-ROCKWOOD flat belt units are put on your drives. Get the most efficient and economical drives for your machines. Ask us for further details.

RHOADS Tannate-Rockwood SHORT CENTER DRIVES

Established 1702

J. E. RHOADS & SONS

35 North Sixth Street, Philadelphia 6, Pa.

NEW YORK • CHICAGO • ATLANTA

Simplifying the Complex!

Industrial Water Conditioning problems are many, varied and complex. There is no "nostrum," no one universal remedy that can be applied. Each requires expert technical study. But there is ONE SIMPLE STEP you can take toward solving such problems . . . turn them over to

BIRD-ARCHER
WATER TREATMENT SYSTEM

Bird-Archer Engineers, Chemists and Laboratory Technicians will analyze your water problems, and apply a CORRECT and adequate method of treatment for your specific conditions, including a system of continuous, accurate control. Through Bird-Archer's sixty years of experience you will be assured of satisfactory results.

Consultation Without Obligation

THE BIRD-ARCHER COMPANY

NEW YORK 17, N. Y.
PHILADELPHIA 40, PA.

CHICAGO 11, ILL.
MONTREAL, CAN.

SURVEYS • PLANT STUDIES • SUPERVISORY SERVICE
PLANT DESIGN • TREATMENTS • LABORATORY SERVICE

PROTECT "Production Steps"

. . . with Inland 4-Way Floor Plate

Any step by an employee that results in a slip or fall has its effect on your profit. The most important movement in your plant is—Production Steps! Steps that must be protected.

Farsighted management looks to Inland 4-Way Floor Plate, relies on it, to safeguard those Production Steps . . . it's the sturdy, faithful guardian of the men who "man" the production line.

Inland's safety floor plate, with its four-way lug, provides a sure grip traction for foot and wheel on floors, walkways, ramps, platforms and steps—any place where accidents could occur.

Made of hot rolled steel, Inland 4-Way Floor Plate practically eliminates maintenance — it won't burn, warp, crack, splinter or absorb liquids and odors. Easily installed and the essence of economy—once placed, Inland 4-Way Floor Plate is there to *stay!* Write today for your copy of the Inland 4-Way Floor Plate catalogue!

Inland Steel Company, 38 South Dearborn Street, Chicago 3, Illinois. Sales Offices: Cincinnati, Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul.

INLAND STEEL CO.

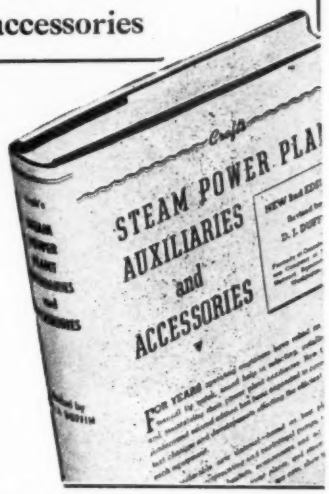
OTHER PRODUCTS: BARS • STRUCTURALS • PLATES • SHEETS • STRIP • TIN PLATE • PILING • REINFORCING BARS • RAILS • TRACK ACCESSORIES

Power generation at least cost and with a minimum of loss—

New 2nd Edition

How to
•select *•install*
•operate *•maintain*
steam power plant
auxiliaries and accessories

Here's a fact-packed manual that demonstrates the wisest selection of steam power plant equipment, and the method of installing, maintaining and operating it that will insure generation of power at the least cost. It describes the facts you need to know about each piece of equipment in clear-cut detail. 534 excellent drawings, diagrams, charts, tables, and photographs illustrating the most up-to-date equipment of a large number of manufacturers illuminate the descriptions. The data presented on pumps, boiler-feeding apparatus, problems of feed-water heating, condensers, steam piping, etc., will enable you to cut losses and upkeep expenses to a minimum.



Just published!

STEAM POWER PLANT AUXILIARIES and ACCESSORIES

TERRELL CROFT, *Editor*
Consulting Engineer, Directing Engineer, Terrell Croft Engineering Co.

Revised by D. J. DUFFIN
Formerly at Consolidated Edison Company of N. Y. and National Research Council, Washington, D. C.

583 pages, 5½ x 8, 534 figures, 7 tables, $5.00

This crack manual provides power plant men with the facts on plant accessories that show results—in power generation at lowered cost, losses and upkeep expenses at a minimum. Its careful, detailed descriptions simplify operating problems and answers the questions that come up on every operating detail. It covers this equipment:

- pump calculations
- direct-acting steam pumps
- crank-action pumps
- centrifugal and rotary pumps
- boiler-feed apparatus
- feed-water heating
- condensers
- steam piping line—and exhaust-steam separators
- steam traps

This new second edition

- includes a practically complete rewriting of the Divisions on reciprocating and centrifugal pumps
  - methods of boiler feeding
  - feedwater heaters
  - economizers and air preheaters
  - condensers
  - steam piping of power plants
  - steam traps
- includes latest revised Standards of
  - the Hydraulic Institute
  - the American Standards Association
  - the American Society of Mechanical Engineers

See it 10 Days FREE • Mail Coupon

McGRAW-HILL BOOK CO., 330 W. 42 St., NYC 18
Send me Croft's Steam Power Plant Auxiliaries and Accessories for 10 days examination on approval. In 10 days I will send $5.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Company .....
Position P-8-46
(For Canadian price, write Embassy Book Co., 12 Richmond St. E., Toronto, 1.)

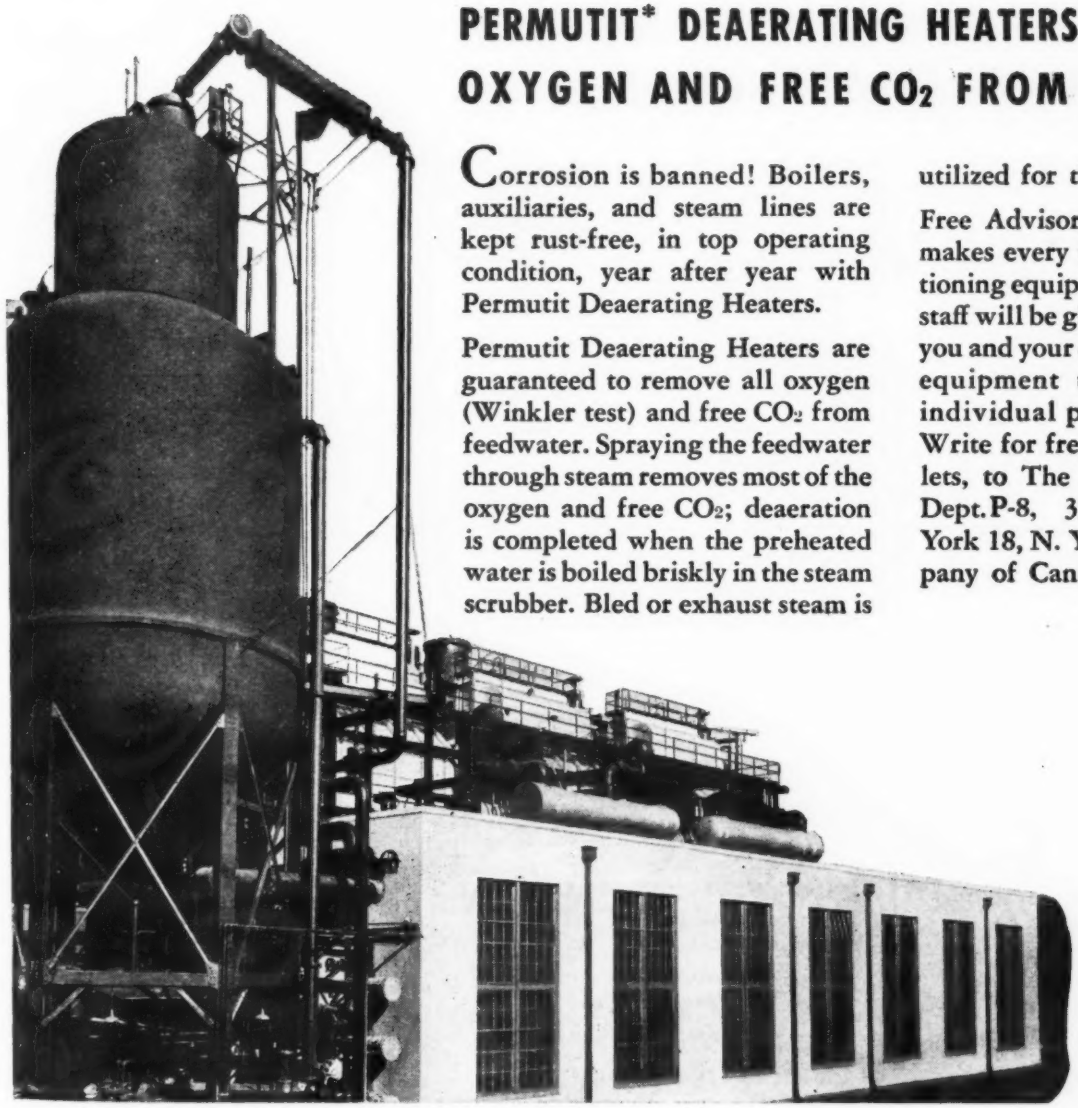
PERMUTIT* DEAERATING HEATERS REMOVE ALL OXYGEN AND FREE CO_2 FROM FEEDWATER

Corrosion is banned! Boilers, auxiliaries, and steam lines are kept rust-free, in top operating condition, year after year with Permutit Deaerating Heaters.

Permutit Deaerating Heaters are guaranteed to remove all oxygen (Winkler test) and free CO_2 from feedwater. Spraying the feedwater through steam removes most of the oxygen and free CO_2; deaeration is completed when the preheated water is boiled briskly in the steam scrubber. Bled or exhaust steam is utilized for the entire operation!

Free Advisory Service! Permutit makes every type of water-conditioning equipment... its technical staff will be glad to cooperate with you and your consultants to design equipment that will fit your individual plant requirements. Write for free, informative booklets, to The Permutit Company, Dept. P-8, 330 W. 42nd St., New York 18, N. Y., or Permutit Company of Canada, Ltd., Montreal.

*Trademark, Reg. U.S. Pat. Off.



PERMUTIT

WATER CONDITIONING HEADQUARTERS

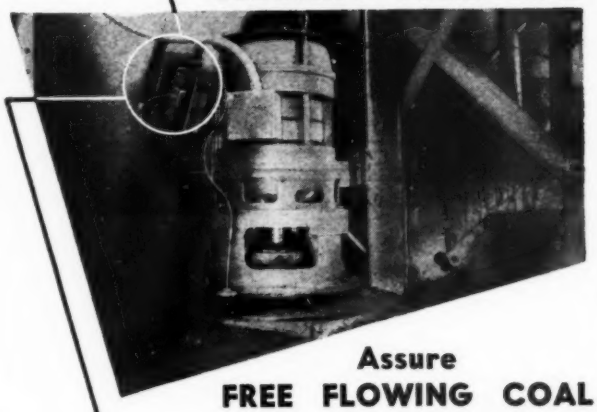
TOUGH OVERLAYS AND PATCHES FOR Concrete or Wood Floors

Resurface or patch broken concrete floors with tough RUGGEDWEAR resurfacer. Here's a material which will stand up under the most punishing traffic conditions. Simple to install—no chopping or chipping required. Merely sweep out the spot to be repaired—mix the material—trowel it on. Holds solid and tight right up to irregular edge of old concrete. Provides a firmer, tougher, smoother, more rugged wearing surface. Used indoors or out. Dries fast.

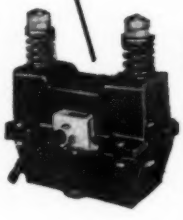
MAIL COUPON for FREE TRIAL OFFER

FLEXROCK COMPANY
3677 Filbert St., Philadelphia 4, Pa.
Canadian Office: 21 King St., E., Toronto, Ont.
Please send me complete RUGGEDWEAR information and details of FREE TRIAL OFFER—no obligation.
Name .....
Company .....
Address .....

SYNTRON
"Pulsating Magnet"
ELECTRIC VIBRATORS



Assure
FREE FLOWING COAL
Bins, Hoppers and Chutes



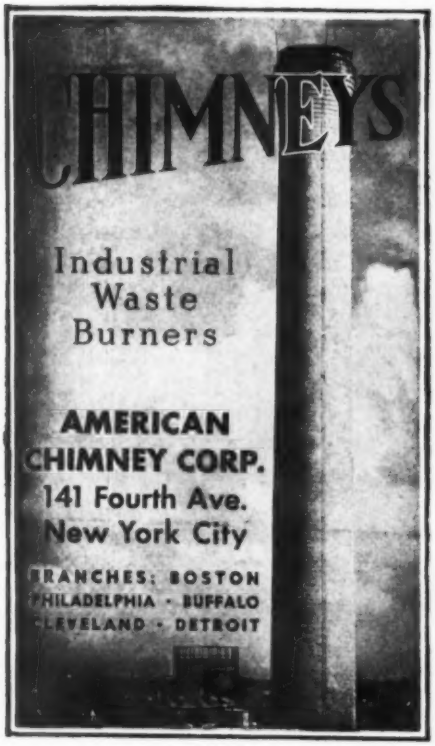
3600 powerful "Electronic-Controlled" vibrations per minute, break down arching and plugging—without damage to prime equipment.

Eliminate pounding and sledging.

Write for illustrated folders

SYNTRON CO., 492 Lexington, Homer City, Pa.

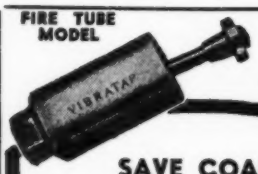
WHERE TO BUY
Featuring additional products and specialties and services for power plants



Industrial Waste Burners

AMERICAN CHIMNEY CORP.
141 Fourth Ave.
New York City
BRANCHES: BOSTON
PHILADELPHIA · BUFFALO
CLEVELAND · DETROIT

FIRE TUBE MODEL



QUICK TUBE CLEANING

SAVE COAL by
removing scale from boiler tubes. Use a VIBRATAP—the Vibratory Cleaner that dislodges the full thickness of the deposit and does a really complete cleaning job. Write for Bulletin K-7.

BRUNT EQUIPMENT CO.
60 S. DIVISION ST. · BUFFALO, N. Y.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

Automatic Control
For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2715 Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO.

TEST SPEEDS and SAVE at a glance
REVOLUTIONS and FEET per min.
SPEED VARIATIONS
BELT SLIPPAGE
Send for Bulletin

O-Z Improved Hand Tachometer-Cutmeter
O. ZERNICKOW CO.
21 Park Row New York 7

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

A Good Habit . . .

This "Where to Buy" Section supplements other advertising in this magazine. . . It's a good habit to check this page—every issue.

OXYGEN-FREE WATER FOR A MODERN BREWERY'S BOILERS

In the John Hohenadel Brewery Inc., at East Falls of the Schuylkill River in Philadelphia, feedwater for the 1,000-hp boiler load is deaerated for removal of dissolved oxygen and other corrosive gases in a 32,000-lb/hr Cochrane Deaerator. Additional storage for returned condensate is provided by the horizontal storage tank with 90 cu. ft. capacity. Both condensate and zeolite-softened makeup are deaerated.

Makeup water is city water taken from the Schuylkill River with hardness averaging 10 grains per gallon and softened in a double-unit high exchange greensand zeolite softener. Each unit of the softener can handle the entire boiler load with 24 hours between regenerations. During normal operation the two units function in parallel.

COCHRANE CORPORATION • 3106 NORTH 17th STREET • PHILADELPHIA 32, PA.

COCHRANE
SINCE 1863
DEAERATORS

Four-foot double-unit Cochrane Zeolite Water Softener.

Three foot diameter Cochrane Deaerator mounted on horizontal storage tank.

PROFESSIONAL SERVICES

CONSULTING · DESIGN · EXAMINATIONS · PATENTS
CONSTRUCTION · PLANS · SURVEY • REPORTS · TRADE MARKS

ASSOCIATED ENGINEERS, Inc.
Joseph C. Lewis, *President*
230 E. Berry St., Fort Wayne 2, Ind.
Management Consultants
Engineering • • Architecture • • Accounting
Organization • • Methods • • Costs

HALL LABORATORIES, Inc.
R. H. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
Hagan Building Pittsburgh (30), Pa.

J. E. SIRRINE & COMPANY
Power Plants · Design · Water
Engineers
Consultation · Reports · Plans
Steam Utilization
Greenville South Carolina

ASSOCIATED ENGINEERING ANALYSIS
CONSULTANTS IN INDUSTRIAL TECHNICS
ENGINEERS MATHEMATICIANS PHYSICISTS
Designing · Time Study · Plant Layout · Work Simplification · Methods Improvement
Research · Nomograms · Charts, Graphs · Cam-Linkage · Computations
Optics · Research · Acoustics · Electronics · Development
Practical Solutions to Theoretical Problems
215 Montague St., Brooklyn 2, N. Y. at Boro Hall

KEGARISE-CRONK ENGINEERING CORP.
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Steam and Electric Utilization
Design — Reports — Plans
334 E. Main St. *P.O. Box 668* Johnson City, Tenn.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

THE BIRD-ARCHER CO.
Engineers and Consultants on Water Conditioning Problems
Surveys . . . Plant Studies . . . Analyses
400 Madison Ave. New York, N. Y.

LUKE L. NAKASHIAN
Engineer
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINERY EQUIPMENT
404 Park Square Building. Boston 16, Mass.

JOHN A. STEVENS
Established 1909
CONSULTING ENGINEERS
Power Plants · Dye Houses · Paper Mills · Surveys
Lowell, Massachusetts

H. E. CORL
CONSULTING ENGINEER
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plants surveys Appraisals Reports
1505 Race Street Philadelphia, Pa.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEER
Design Operations
Steam - Hydraulic - Gas
231 S. LaSalle St., Chicago (4), Ill.

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisal
80 Broad Street, New York 4

E. R. GARLOCK & ASSOCIATES INC.
Industrial Mechanical & Electrical Maintenance Engineers
Complete plant and power maintenance, rehabilitation, installation, construction, inspection, performance and efficiency supervision.—Emergency repairs. High pressure power units a specialty.
201-202 Delaware Bldg. Akron 8, Ohio

SANDERSON & PORTER
ENGINEERS
AND
CONSTRUCTORS

WHITMAN, REQUARDT AND ASSOCIATES
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md.

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Industrial and Utilities
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examinations—Laboratory
61 Broadway New York
1417 K Str. N.W. Washington, D. C.
17 & Sansom St., Phila., Pa.

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

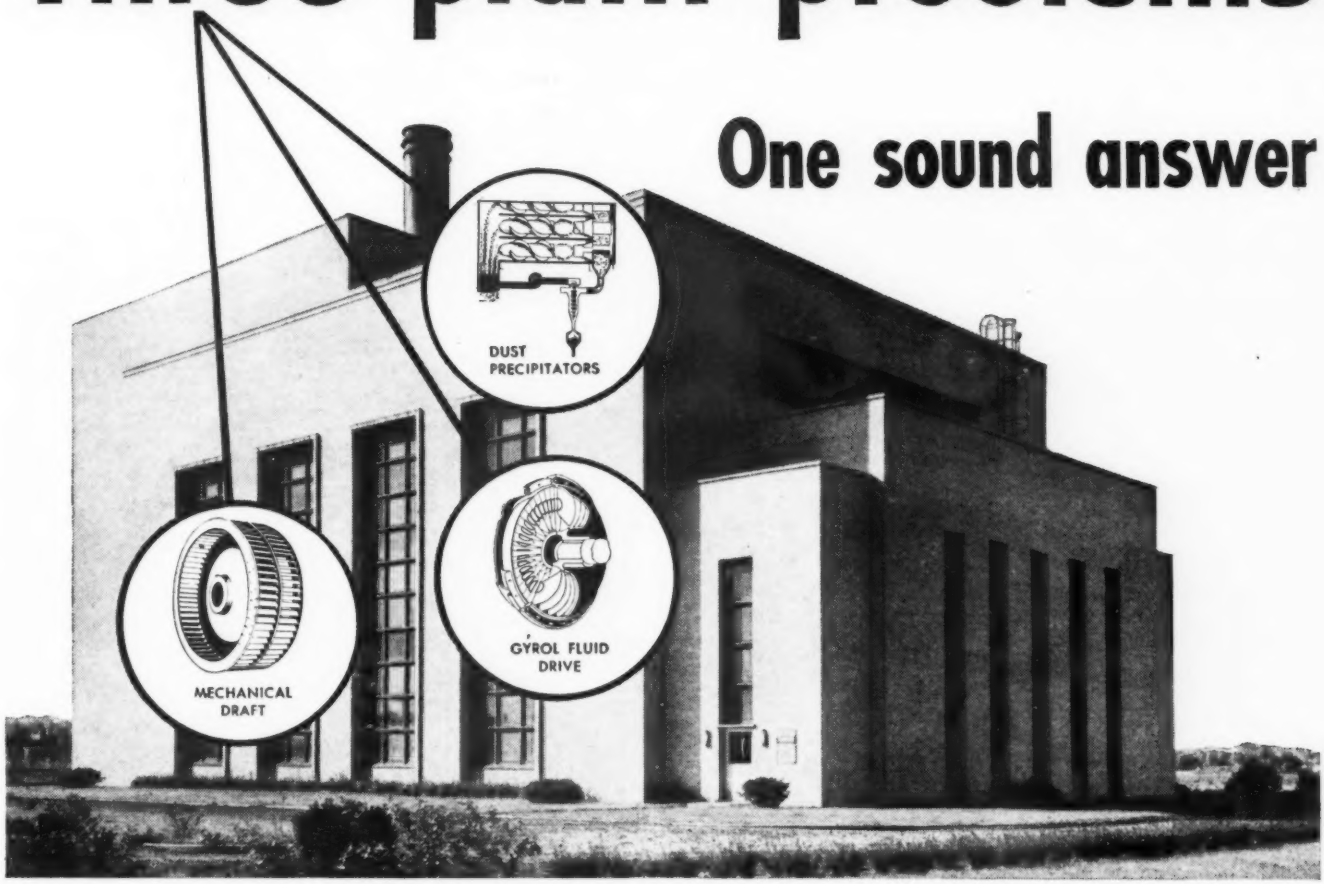
READERS MAY CONTACT THE CONSULTANTS
whose cards appear on this page
with the confidence justified by the offering of these special services nationally.

THE CONSULTING ENGINEER

"By reason of special training, wide experience and tested ability, coupled with professional integrity, the consulting engineer brings to his client detached engineering and economic advice that rises above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he costs him."

Three plant problems

One sound answer



Mechanical Draft Fans . . . Dust Precipitators . . . and Gyrol Fluid Drives — buy all 3 from ABC. By doing so, you have one source of technical information, far less red tape, and you get undivided responsibility on 3 plant problems.

Buy all 3 from ABC

Under gruelling wartime operating conditions, American Blower Mechanical Draft Fans, Dust Precipitators and Gyrol Fluid Drives have proved their merit in power plant operation.

As a result, the word is going round: "Buy all 3 from ABC for better overall power plant efficiency." Naturally, we take pardonable pride in the performance record of these products—both before and during the war years.

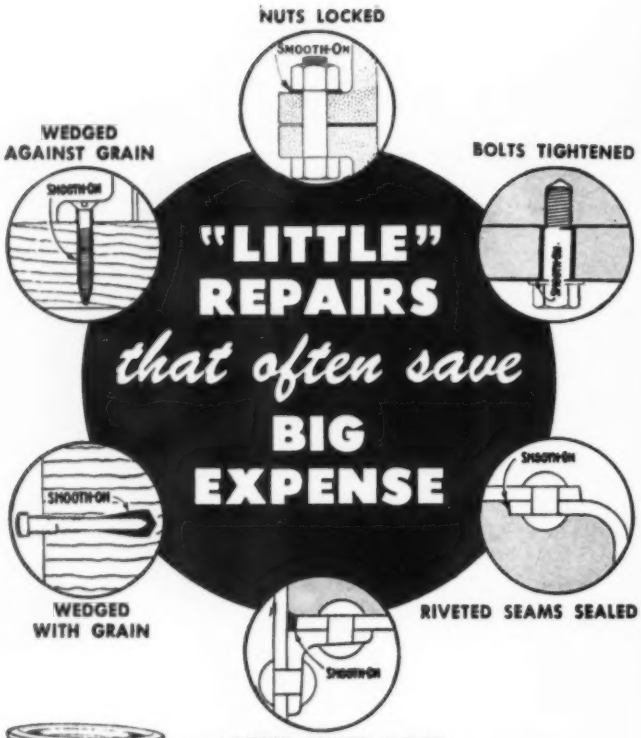
If you already have American Blower equipment—you know all about their operating characteristics. If you haven't, we'd like to tell you our story. You'll like having one source of supply, one representative well versed in all 3, and undivided responsibility.

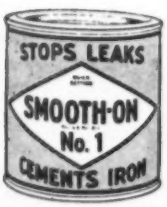
Just phone, or write, the nearest American Blower Branch Office. There is one close at hand!

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION





One loose bolt, nut, screw or rivet can cause a breakdown, delayed production, much expense. Caught in time and tightened with

SMOOTH-ON No. 1

Iron Repair Cement, the trouble and expense are averted.

Bolts and nuts worn or stripped loose are easily made tight again with an application of Smooth-On No. 1.

Wood screws that have lost their grip, whether set against the grain or with it, take hold firmly again when coated with Smooth-On No. 1.

Leaking riveted seams and joints can be made water- and air-tight again with Smooth-On No. 1, and no need of using heat or special apparatus.

And these repairs last. Because Smooth-On expands slightly as it sets, filling cracks and crevices and openings tightly, firmly, resistingly.

Get Smooth-On No. 1 from your supply house. If they haven't it, write us. Packed in sizes from 7 oz. up.

FREE *40-Page Repair Handbbook*

Gives clear-cut directions for repairing plant and home equipment of many kinds. 170 diagrams. A book every engineer and mechanic wants—over 1,000,000 now in circulation. Send coupon for your copy.

Sign and Send Now

SMOOTH-ON MFG. CO. Dept. 30
570 Communipaw Ave., Jersey City, N. J.

Please send SMOOTH-ON HANDBOOK

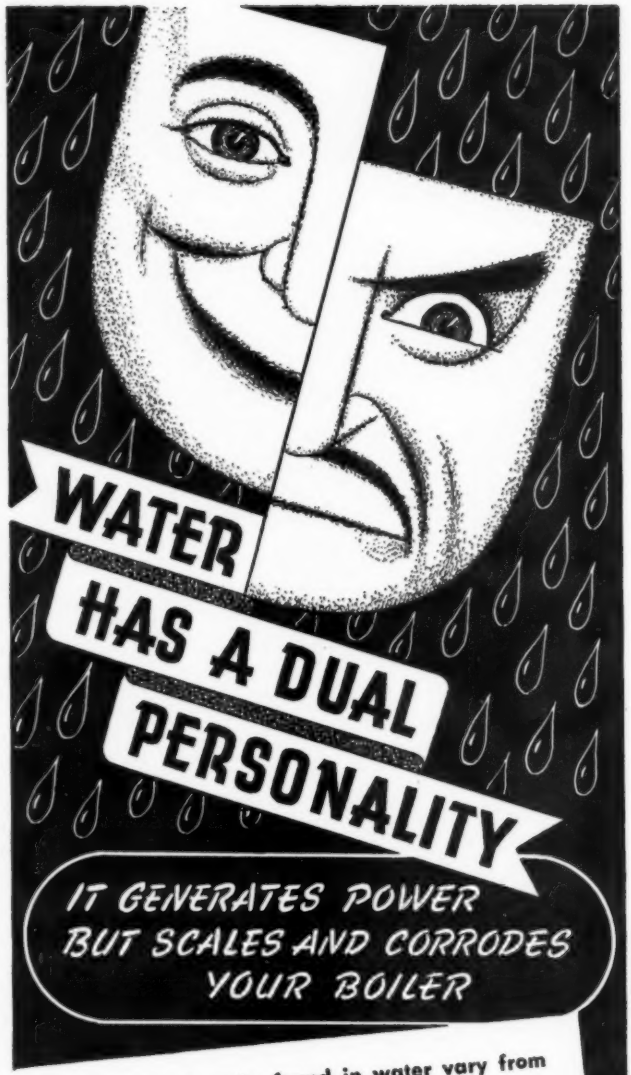
Name.....

Address.....

.....

8-46

Do it with SMOOTH-ON



● Chemical deposits found in water vary from place to place and from time to time.

● Your Boiler Feedwater Treatment must be individually prepared to cope with the water problems in your locality. It must be periodically checked to observe chemical changes. It must be geared to your operating conditions.

● DRY PINK Boiler Feedwater Treatment is an individual formula prepared by our Chemical and Engineering Staff after a complete analysis of your boiler feedwater is made. This scientific product will dissolve and remove scale now present. It will prevent further accumulation of scale and corrosion.

● Our work does not end with the preparation of the special DRY PINK formula. The work is carried on by the coordinated efforts of the Service Technicians working in the field, and our Laboratory Technicians. Periodical check-ups are made in your plant. Your boiler room equipment is inspected and recommendations are made for the maximum boiler efficiency.

● To prolong the life of your boiler—to increase its efficiency—to reduce fuel and maintenance costs—use DRY PINK. Write for full particulars.

Dominion CHEMICAL CO., Inc.
WATER CONSULTANTS AND CHEMISTS
FOR INDUSTRIAL AMERICA
11 WEST 42nd ST. • NEW YORK 18, N.Y.

WANTED

MECHANICAL ENGINEER

For Steam Power Plant Design

An unusual opportunity for a young engineer well grounded in steam power plant design to join a growing organization

WESTCOTT & MAPES, INC.
New Haven, Connecticut

WANTED

Position of assistant power plant superintendent open in large woodworking plant near Chicago. Requires good working knowledge of steam and electricity generation, power plant maintenance, water softening and experience in power plant supervision.

Give all pertinent information in first letter. All inquiries will be held confidential.

The Singer Manufacturing Co.
2115 Western Avenue
South Bend, Indiana

WANTED

MECHANICAL ENGINEER

Mid-west operating company desires services of a Mechanical Engineer, 40 to 45 years of age, having experience in Power Plant design and operation, and qualified to eventually assume supervisory responsibilities. Applicants state age, education, experience, date available and salary range.

P-165, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED

VALVE DESIGNER

Preferably with some experience. A good position with an excellent opportunity, with a substantial and steadily growing company in the Chicago area. Write a full statement of qualifications. Address

P 168, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED

STRUCTURAL ENGINEER

For Design of Structural Steel and Reinforced Concrete Structures

An unusual opportunity for a young man experienced in the design of structural steel and reinforced concrete to join a growing organization.

WESTCOTT & MAPES, INC.
New Haven, Connecticut

POSITIONS VACANT

LARGE INDUSTRIAL Concern has opening for graduate engineer under 36 years of age who is experienced in Construction & Mechanical Engineering. Excellent opportunity for right man to advance. Must be willing to travel and supervise construction and machinery installation at various company properties. Give qualifications, experience and photo. All communications will be answered and held in confidence. P-132, Power, 330 W. 42nd St., New York 18, N. Y.

ENGINEER: LICENSED in New York City. For full charge maintenance. Large dry cleaning plant. $100 to start. Write P-169, Power, 330 W. 42nd St., New York 18, N. Y.

CENTRIFUGAL PUMP Design Engineer. Old established small concern. Opportunity for junior designer now with large company. Write fully experience history and salary expected. Our employees advised. P-170, Power, 330 W. 42nd St., New York 18, N. Y.

MAINTENANCE CHIEF: take complete charge of plant and auto maintenance, 15 to 18 men in dept. Must be prepared to pitch in when required. Salary $4,400. Good chance for improvement. Messing Bakeries, Inc., 821 Bergen Street, Brooklyn 16, New York, Main 2-8600.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of 36 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SELLING OPPORTUNITY WANTED

NORTHERN ILLINOIS and WISCONSIN. Professional engineer well acquainted with leading power plants in this territory wants one or two additional high-grade lines. RA-171, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED

ELECTRICAL ENGINEER

For Power Plant Design
Must have Public Utility Experience

WESTCOTT & MAPES, INC.
New Haven, Connecticut

WANTED

Sales Representatives

Have a few good territory openings for aggressive sales representatives. An old established line of plastic insulation that has been proven successful on all types of boilers, boiler-room equipment, tanks, pipes, furnaces of all types, open hearth, reheat, etc. The line is well advertised and backed by an old, well-financed corporation. This is a real opportunity. State experience and territory wanted. Address

RW-162, Power
520 North Michigan Ave., Chicago 11, Ill.

SALESMAN

Long established and progressive manufacturer of Boiler Water Treatment and Kindred Products has money-making opportunities in the Midwest, South and East for aggressive salesmen—exclusive territories—liberal commissions—send full details, selling experience, etc., to

SW-166, Power
330 West 42nd St., New York 18, N. Y.

DIVISIONAL SALES MANAGER

Desired by nationally known manufacturer of electrical and mechanical control equipment for industrial applications. Technical sales background required. Salary plus commission. In reply give full details.

SW-161, Power
68 Post Street, San Francisco 4, Calif.

SALES ENGINEERS!

With mechanical or chemical engineering background. Excellent opportunity for hard workers with real sales ability in key locations all over the United States. We are well known manufacturers of nationally advertised chemicals for the scientific conditioning of industrial water—car essential; experience in this line unnecessary—our organization knows about this advertisement. Write fully age, education, sales experience, salary requirements.

SW-167, Power
330 West 42nd St., New York 18, N. Y.

OIL BURNER SALES ENGINEER

FINE OPPORTUNITY for experienced oil burner sales engineer, with one of the East's largest, well-established fuel and heating equipment companies. Must be familiar with steam boiler applications, high and low pressure boilers and piping, & industrial oil-fired equipment. Major responsibility will be to make surveys and work up estimates for the installation of industrial oil-burning equipment. Salary open. Write, giving complete resume of experience, photograph, and salary requirements. Address

EDWARD V. DITTOE
Griffith-Consumers Company
1413 New York Avenue, N. W., Washington 5, D. C.

We Invite Ambitious
INDUSTRIAL SALESMEN

who want a permanent connection with a real future, with one of America's recognized leaders in the industrial stoker and combustion engineering field to write us. In certain locations, we can help an alert energetic individual get started as a dealer, in business for himself, by selling our engineering and equipment. A good salesman or dealer who applies himself, should net from $6000 up annually. ADDRESS: Secretary, P.O. Box 879, Chicago, Ill.

FOR SALE

40-Year Old Steam Specialty Business with nation-wide reputation.

BO-164, Power
520 North Michigan Ave., Chicago 11, Ill.

YOUR ASSETS and CAPITAL STOCK are WORTH MORE NOW
We are willing to

PAY YOU CASH

For Your
- **INDUSTRIAL PLANTS**
- **MFG. DIVISIONS or UNITS**

We are principals acting in our own behalf. All transactions held in strictest confidence. Personnel retained wherever possible.
Address: Box 1234 147 W. 42 St., New York 18, N.Y.

FOR SALE

1—Westinghouse, 40 HP, 115 volts DC, 1750 RPM, 300 amp. type SK Motor.
1—Westinghouse, 75 HP, 115 volts D.C. motor, style 12-213, 350-450 RPM.
1—Otis, 10 HP, 110 volts D.C., 750 RPM, type 77G.
All in good condition

FS-163, Power
330 West 42nd St., New York 18, N. Y.

Equipment Wanted Advertising—page 334

Dependable Rebuilt Electrical Equipment

1 YEAR GUARANTEE

3 Ph. Squirrel Cage Motors

Qu.	H.P.	Make		Speed
6	150	Howell	BB	1750
1	147	West.	25 cyc.	715
1	100	G.E.	KT	1150
1	60	Burke		690
1	50	West.	CCL	1150
1	50	Cr. Wh.	1220	1150
1	50	West.	CS	580
1	50	G.E.	KT	580
1	50	G.E.	I-14	495
1	40	Triumph	TR	690
1	35	Wagner		850
1	30	U.S.	Vert.	3450
1	30	Cr. Wh.		870
1	30	Watson		850
1	30	West.	CCL	690
1	25	Wagner	Fy. Welch.	1200
1	25	Wagner	Vert.	1160
1	25	G.E.	IK	870
2-20/10		West.	TEFC	1160/580
1-20/10		West.	TEFC	885/440
1	20	G.E.	KT-312	1700
1	20	G.E.	Vert.	1750
1	20	R & M	K-207	1160
1	20	G.E.	Vert.	1175
1	20	Al. Ch.		870
1	15	Wagner	Fy. Welch.	1800
1	15	El. Spec.	Synch.	1800
1	15	G.E.	KT-312	1150
1	15	Howell		1150
1	15	Al. Ch.		1150
1	15	G.E.	Vert.	1150
1	15	Lincoln		1150
	15	West.	MS	1150
1	15	G.E.	Vert.	870
1	15	Wagner	15VPR	860
1	15	Wagner	Fy. Welch.	720
1	15	West.	CS-504	415

2 Ph. Squirrel Cage Motors

Qu.	H.P.	Make		Speed
1	50	Lincoln	C-15	870
1	50	G.E.	IQ	870
1	40	Al. Ch.		870
1	30	West.	CCL	1150
1	25	Burke		870
3	25	G.E.	IQL	1150
1	25	West.	CCL	1150
1	15	G.E.	KQ-502	1150
1	15	West.	CS	1155
1	15	Al. Ch.		1130
1	15	West.	CS-572	860
1	15	G.E.	IQ	690

A.C. Slip Ring Motors

Qu.	H.P.	Make	Type	Speed
1	200	G.E.		1200
1	112	G.E.	ITC	720
1	75	West.	CW	600
1	75	Al. Ch.	Hoist	575
1	64	G.E.	MTO-552	585
1	50	G.E.	MT 2300 V.	600
1	52	G.E.	ITC	860

LEEDS & NORTHRUP MICROMAX

INDICATING THERMOCOUPLE PYROMETERS

Model S Recorders
Model C Controllers
Model R Recorders

Some New—
All Others Equal to New

1	50	Al. Ch.		865
1	50	G.E.	MT-342	860
1	40	West.	HF	850
1	40	G.E.	MT	1200
1	40	G.F.	MT 2300 V.	570
1	35	Al. Ch.		870
1	30	G.E.	ITC	1200
1	30	G.E.	MQ-332	870
1	30	West.	CI-574A	870
4	30	West.	CI-582C	870
2	30	G.E.	MT-542	690
1	25	Al. Ch.		870
1	25	Howell	SRS-420	870
1	25	G.E.	1M	565
1	20	West.	CW	870
1	15	West.	CW	870
1	15	G.E.	MT-512	845
1	15	Al. Ch.		680
1	15	G.E.	MQ-332	670
2	7½	L-A	OL326	870
1	5	L-A	OH254	1750

A.C. Generators

Qu.	KW.	Make	Voltage	Speed
1	150	G.E.	220/440	1200
1	150	G.E.	240/480	600
1	133	West.	G	1200
1	100	El-Mchy	208/120	1200
1	100	West.	240/480	600
2	30	Century	208/120	1200

230 Volt D.C. Motors

Qu.	H.P.	Make	Type	Speed
1	600	West.	SK	700/2000
1	350	West.	SK	340/425
1	125	West.	SK190	600
1	100	West.	SK180	625
1	75	West.	SK180	475
5	60	West.	SK160	680
1	60	G.E.	C-Inter.	480/1100
1	50	G.E.	RC-19	400/1200
1	45	Diehl	K-10	850
1	40	G.E.	DLC	1050
2	35	West.	SK-120	1150
1	35	G.E.	RLC-204	440/800
2	35	West.	SK-160	400/600
1	30	G.E.	RC-32	1100
1	30	West.	SA	500/1500
1	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Reliance	92T	1150
1	25	Al. Ch.		850
1	25	Rel.	MS	500/1500
1	25	G.E.	RF	400/1200
3	20	G.E.	RF	500/1500
1	20	G.E.	RF	400/1200
1	20	G.E.	CD-83	1200
1	20	R. & M.		1160
1	20	El. Dyn.	7½-S	950
3	20	West.	SK-110L	750
1	20	West.	Hoist	700
1	15	Rochester		3450
1	15	West.	SK-83	1150
2	15	G.E.	RC	1150
1	15	G.E.	CD-Vert.	900
1	15	G.E.	CD-85	850
2	15	G.E.	RC-30	850
1	15	Reliance	T155	400/1600
1	15	Sprague	D	700
1	15	West.	SK	675/1350
1	15	West.	SK-100L	600/2500
2	15	West.	SK	500/1500
1	9	L-A	Baler	1750
4	10	G.E.	RC	1150
2	10	G.E.	CD-75	1150
1	10	Diehl		900
1	10	G.E.	RC	29/850
1	10	G.E.	CD-83	850
1	10	Roth		800
1	10	Diehl	LS-14	750
1	10	West.	Elevator	700
1	10	G.E.	CVC	700
1	10	West.	SK	600/1200
1	10	G.E.	RLC	500/1500
1	10	West.	SK	500/1500
1	10	El. Dyn.		450/1800
2	10	West.	SA	400/1200
1	10	West.	SK-90	400/1200
1	10	Diehl		200/247
1	7½	Sturt.	TF	3600
1	7½	El. Dyn.	2S	1750
1	7½	G.E.	RC	1150
6	7½	West.	SK-40	1180
1	7½	G.E.	CO-1804	
1	8	L-A	Baler	1200
2	7½	West.	SK	890
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
2	7½	G.E.	RF-9	600/1800
1	7½	G.E.	RF-10A	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dyn.	3S	550/1650
1	7½	G.E.	RF-10	450/1800
1	7½	G.E.	RF-10	450/1600
1	7½	G.E.	RF	450/1800
2	7½	West.	SK-70	400/1600
1	7½	Al. Ch.		350/1050
1	7½	L-A	Baler	

110 Volt D.C. Motors

Qu.	H.P.	Make	Type	Speed
1	45	G.E.	RC	1100
1	20	G.E.	CD83	1750
1	20	G.E.	CD95	1150
2	10	Lincoln	I-SC	3500
1	10	E. Dyn.	3S	1100
1	10	West.	SK-70	1150
1	10	G.E.	CD73	1150
1	10	Reliance		400/1600
2	10	Diehl		230
1	7½	G.E.	CVC	725
1	7½	El. Dyn.	5S	450/900
1	7	El. Dyn.		600/1200

D.C. Generators

KW.	Make	Voltage	Ampere	Speed
300	Burke	250/125	1200	900
300	West.	250	1200	900
300	Cr. Wh.	250/125	1200	1200
250	G.E.	125	2000	720
200	Cr. Wh.	550	363	900
100	G.E.	125	800	1150
100	Al. Ch.	250/125	400	1150
50	G.E. (2)	125	400	1150
50	G.E.	250	200	870
30	El. Dyn.	600	50	1150
30	G.E.	125	240	1150
25	G.E.	125	200	1150
20	West.	250	100	1150
10	West.	250	40	1150
10	West.	125	80	1150
7½	G.E.	250	30	1150
7½	West.	125	60	1150

AIR COMPRESSORS

12½"x12"	American
10"x6"	Gardner
9"x8"	Ingersoll Rand
9"x8"	Sullivan

300 K.W.
3 Wire, 250/125 Volt
Direct Current
Synchronous Motor Generator Set

Specifications:

Generator: 300 KW—Type CB67, 900 RPM, 1200 amperes, compound interpole, serial No. 136129.

Motor: Synchronous 450 H.P. —Type AC88, 3 phase, 60 cycle, 4150 volts, .85 P.F., serial No. 136011.

Equipment: D.C. Panel Board and Reduced Voltage A.C. Starting Panel.

Late Modern Equipment — Like New

THIS IS A PARTIAL LIST ONLY!

L. J. LAND & COMPANY

146 GRAND STREET, NEW YORK 13, NEW YORK

Established 1910 **CAnal 6-6976**

BOSTON, MASS., 411 Atlantic Ave., Phone: Liberty 4300

READING, PENNA., 10th & Exeter Sts. Phone: Reading 2-6866

When you buy Electrical Equipment- look to—

the judgement of experienced Electrical Engineers who KNOW Electrical Equipment

Hemphill rebuilding and testing is done under engineering supervision

MOTOR GENERATOR SETS

1—300 K.W. G. E. 275 V. 3 unit syn. motor 4150 V. 720 RPM.
1—150 K.W. Westinghouse 125 V. Sq. Cg. 220 V. 3 phase 900 RPM.
1—125 K.W. Crocker-Wheeler 125 V. Sq. Cg. 2300 V. 3 phase, 1200 RPM.
2—100 K.W. G. E. 230 V. A. C. Sq. Cg. 440 V. 3 phase, 60 cy. 1200 RPM.
1—80 K.W. Crocker-Wheeler 3 unit 125 V. Syn. Motor, 220 V.
6—17 K.W. Allis-Chalmers 3 unit 120 V. sq. Cg. 220 V. 1800 RPM.

TURBO GENERATORS

1—600 KW. Terry dual bleeder condensing Turbine only
1—300 KW. 125/250 Volt General Electric non-condensing
1—300 KW. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—30 KW. 135 volt, Allis-Chalmers, non-cond.

ALTERNATORS

1—500 KW. 3600 RPM. 600 volt, General Electric D.C. exciter
1—200 KVA 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter
1—180 KW. 514 RPM. 550 volt, Westinghouse
1—165 KW. 514 RPM. 2400 volt, Electric Mach.
1—62½ KW. 3600 RPM. 220 volt, Allis-Chalmers
1—40 KW. 1800 RPM. 550 volt, General Electric
1—35 KW. 1200 RPM. 240 volt, Columbia Electric D.C. exciter
1—31.3 KVA. 1200 RPM. 120/208 volt, American D.C. exciter
1—12.5 KVA. 1200 RPM. 240 volt, Westinghouse, D.C. exciter

TRANSFORMERS

1—1000 KVA. Auto Transf. 4150 V. 3 Ph. 4 wire to 2406 V. 2 Ph.
2—400 KVA. General Electric, 4156-250/480 volt, Scott taps
3—200 KVA. Pittsburgh 2200 volt 110/220
3—150 KVA. General Electric, type KT, 3 phase, 4150 volt to 120/208
3—100 KVA. Westinghouse 11430/250 volt
3—100 KVA. General Electric 13200/250 volt
3— 75 KVA. General Electric 13500/750/440 volt
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v. with Motors

MOTORS—VARIABLE SPEED
230 VOLTS

2—200 H.P. 425/212 RPM. General Electric MPC
2—100 H.P. 950/1170 RPM. General Electric RC-37
1—40 H.P. 700/1000 RPM. Sprague L.C.
1—30 H.P. 400/120 RPM. General Electric RC-204
1—25 H.P. 650/2200 RPM. Westinghouse SK1110L
1—25 H.P. 500/1500 RPM. General Electric RF-12
1—25 H.P. 400/1200 RPM. Westinghouse SK
2—25 H.P. 300/900 RPM. Electro Dynamic
1—15 H.P. 300/1200 RPM. General Electric RLC-2024
1—13/18 H.P. 350/1200 RPM. Electro Dynamic
3—11½ H.P. 500/1500 RPM. Westinghouse
1—7½/10 H.P. 500/1500 RPM. Reliance
1—6/7.5 H.P. 450/1800 RPM. Crocker-Wheeler CMC
1—5 H.P. 500/1500 RPM Reliance
1—5 H.P. 600/1200 RPM. General Electric LC
1—5 H.P. 450/1800 RPM. Crocker-Wheeler CM
1—5 H.P. 400/1600 RPM. Diehl K6
1—5 H.P. 225/900 RPM. Electro-Dynamic

MOTORS 3 PHASE 60 CYCLE
SLIPRING

1—500 H.P. 900 RPM. Lincoln 440 volt
1—350 H.P. 293 RPM. General Electric MT-424 440 volt
1—250 H.P. 600 RPM. General Electric IM 2200 volt
1—225 H.P. 1800 RPM. General Electric I-L 220 volt
1—200 H.P. 600 RPM. Crocker-Wheeler S.R. 440 volt
1—200 H.P. 600 RPM. Westinghouse CW 220 volt
1— 75 H.P. 900 RPM. General Electric ITC 220 volt
1— 60 H.P. 575 RPM. Allis-Chalmers 220 volt
1— 40 H.P. 1150 RPM. Cont Electric SA85 220 volt
1— 40 H.P. 1130 RPM. General Electric MT. 2200 volt

MOTORS 3 PHASE 60 CYCLE
SQUIRREL CAGE

1—400 H.P. 1200 RPM. Westinghouse 220 volt
2—200 H.P. 1200 G.E. 1K. 2200
2—100 H.P. 1200 RPM. General Electric, 220 volt, type KT and KF
1— 90 H.P. 380 RPM. Crocker-Wheeler 550 volt
1— 75 H.P. 690 RPM. Westinghouse 550 volt
1— 60 H.P. 900 RPM. Howell Mfs. Co. SC 220 volt
2— 50 H.P. 900 RPM. Fairbanks-Morse H, 220 volt
2— 25 H.P. 1800/1200/900/600 U. S., 440 volt, 3 phase

GASOLINE DRIVEN D. C. GENERATOR SETS

1—300 K.W. 250 V. G. E. MPC 1000 RPM
2—250 K.W. 250 V. Crocker-Wheeler Gen. 1200 RPM
1— 75 K.W. 250 V. Westinghouse 260 RPM
1— 50 K.W. 115 V. Westinghouse 1200 RPM
2—31.25 K.W. 125 V. Westinghouse 1400 RPM
2—20 K.W. 50 V. G. E. 1800 RPM

MOTORS D. C. 230 VOLTS

2—450 H.P. General Electric MPL 250 volt 400 RPM.
1—250 H.P. 750 RPM. Electro Dynamic 230 volt
1—125 H.P. 1725 RPM. General Electric RC—230 volt
1—75 H.P. 575 RPM General Electric C230 volt
2— 50 H.P. 700 RPM. Crocker Wheeler CM 230 volt
2— 30 H.P. 1150 RPM. General Electric RC-31 230 volt
1— 30 H.P. 1100 RPM. General Electric RC-12 230 volt
1— 30 H.P. 750 RPM. General Electric RC-14 230 volt
1— 30 H.P. 625 RPM. General Electric C 230 volt
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt
1— 20 H.P. 800 RPM. General Electric RC-12 230 volt
1— 15 H.P. 350 RPM. Diehl G-312 230 volt

SYNCHRONOUS MOTORS

1—500 KVA. G. E. 900 RPM. ATI 4150 V. D. C. exciter
2—160 H.P. Elec. Mach. 1800 RPM. 2200 V. D. C exciter
1—75 H.P. G. E. 1200 RPM. ATI 220 V. 3 phase
2—50 H.P. G. E. 1800 RPM. TS 220 V.
1—50 H.P. G. E. 1800 RPM, ATI 220 V. D. C. exciter
1—35 KVA. G. E. 1200 RPM. ATI 2200 V. D. C. exciter
1—20 H.P. Westinghouse 1800 RPM. 220 V. .8 P.F.

FREQUENCY CHANGERS

1—7½ K.W. 15 KVA. 50% P.F. 1800 RPM. 215 V. 270 Cy. C.W. Westinghouse
2—15 K.W. G. E. Type MM, 270 cy.

VERTICAL MOTORS

4—100 G. E. Vert. Hollow Shaft 1200 RPM. 220 S.C.
1—100 G. E. Vert. Solid Shaft 900 RPM. 220 S.R.
1— 75 G. E. Vert. Solid Shaft 1200 RPM. 220 S.R.
1— 60 Westinghouse Solid Shaft 900 RPM. 2200 S.R.

MISCELLANEOUS

2—2100 Gallon Pumps Dayton-Dowd 100 foot head.
4—12,000 GPM 21' head Axial Flow Vertical Pumps with Motors

JLH

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY

TURBINE UNITS
Condensing
3 Phase 60 Cycle

15630 KVA G.E.	6600 V. 185#
15300 KVA Wstgh.	13800 V. 200#
12500 KVA Wstgh.	2400 V. 200#
10715 KVA G.E.	2300 V. 200#
9375 KVA G.E.	2300 V. 180#
6250 KVA Wstgh.	4000 V. 175#
6250 KVA Wstgh.	2400 V. 200#
5000 KVA Wstgh.	2300 V. 160#
4375 KVA G.E.	2300 V. 175#
4000 KVA Allis	600 V. 150#
3750 KVA G.E.	480 V. 150#
3750 KVA Wstgh.	2300 V. 165#
3750 KVA G.E.	600 V. 175#
3125 KVA Wstgh.	2400 V. 175#
3125 KVA Wstgh.	600 V. 250#
2500 KVA G.E.	2300 V. 200#
2500 KVA G.E.	600 V. 155#
2500 KVA Wstgh.	2300 V. 200#
1875 KVA G.E.	480 V. 135#
1875 KVA G.E.	240 V. 200#
1875 KVA G.E.	2300 V. 175#
1875 KVA Allis	480 V. 175#
1563 KVA Allis	2300 V. 210#
1563 KVA G.E.	600 V. 175#
1563 KVA G.E.	2300 V. 150#
1560 KVA Wstgh.	2400 V. 175#
1250 KVA Allis	480 V. 150#
1250 KVA G.E.	2300 V. 175#
1250 KVA Wstgh.	2400 V. 240#
937 KVA G.E.	2300 V. 150#
750 KVA G.E.	2300 V. 150#
625 KVA G.E.	240 V. 200#
625 KVA G.E.	2300 V. 170#

TURBINE UNITS
Automatic Extraction
3 Phase 60 Cycle

3650 KVA Wstgh. 2300 V. 150#, 10# extraction

1875 KVA Wstgh. 240 V. 400#, 90# extraction

1250 KVA G.E. 2300 V. 150#, 10# extraction

1250 KVA Allis 480 V. 300#, 35# extraction

1250 KVA Allis 480 V. 150#, 12# extraction

938 KVA Allis 2300 V. 175#, 25# extraction

780 KVA Wstgh. 2300 V. 185#, 15# extraction

750 KVA G.E. 600 V. 200#, 10# extraction

625 KVA Wstgh. 480 V. 250#, 5# extraction

TURBINE UNITS
Noncondensing
3 Phase 60 Cycle

6250 KVA Allis 4600 V. 425#, 185# back pressure.

1875 KVA Wstgh. 240 V. 400#, 90# back pressure.

1250 KVA Allis 480 V. 150#, 5# back pressure.

625 KVA Allis 2300 V. 190#, 85# back pressure.

625 KVA G.E. 240 V. 200#, 50# back pressure.

625 KVA Allis 2300 V. 185#, 110# back pressure.

312 KVA C.W. Moore 240 V. 425#, 18# back pressure.

250 KVA Wstgh. 600 V. 150#, 15# back pressure.

250 KVA Wstgh. 480 V. 300#, 30# back pressure.

250 KVA G.E. 220 V. 240#, 5# back pressure.

TURBINE UNITS
Mixed Pressure
3 Phase 60 Cycle

2500 KVA G.E. 2300 V. 150# and 20# pressure.

1250 KVA Wstgh. 4000 V. 150# and 2# pressure

1250 KVA G.E. 2300 V. 125# and 2# pressure.

940 KVA Wstgh. 2300 V. 150# and 4# pressure.

COMPLETE POWER PLANTS
3 phase 60 cycle

3125 KVA Wstgh. turbine unit 600 volts, 250#, 200 deg. sup. with surface condenser and pulverized coal fired boiler.

1250 KVA (2) Wstgh. turbine units 2400 volts, 250#, 150 deg. sup. with surface condensers and two stoker coal fired boilers.

750 KVA (2) Skinner uniflow engine units, 2400 volts, 175#, O deg. sup. 15# B.P. with two stoker coal fired boilers.

UNIFLOW UNITS
3 phase 60 cycle

1000 KVA Skinner 2300 V. 115#
750 KVA (2) Skinner 2300 V. 175#
750 KVA Chuse 2300 V. 175#
500 KVA Chuse 2300 V. 150#
400 KVA (2) Skinner 240 V. 165#
375 KVA Skinner 480 V. 150#
350 KVA Ames 2300 150#
156 KVA (2) Skinner 240 V. 150#
150 KVA Ames 240 V. 150#

UNIFLOW UNITS
Direct Current

750 KW (2) Skinner 250 V. 160#
300 KW Skinner 250 V. 150#
200 KW Ames 125/250 V. 3-wire 150#
125 KW Skinner 115/230 V. 3-wire 125#

DIESEL UNITS
3 phase 60 cycle

675 KVA (3) Rathbun 440 V. 360 RPM
625 KVA Gen. Mot. 2300 V. 720 RPM
450 KVA Fulton 2300 V. 164 RPM
375 KVA Chic. Pne. 2300 V. 257 RPM
312 KVA Bus. Sul. 2300 V. 225 RPM
300 KVA Fair. Mor. 2300 V. 257 RPM
250 KVA Gen. Mot. 440 V. 900 RPM
250 KVA Buckeye 240 V. 514 RPM
150 KVA Fair. Mor. 2300 V. 257 RPM
118 KVA Winton 240 V. 400 RPM
75 KVA Gen. Mot. 440 V. 1200 RPM

MOTOR GENERATORS
3 phase 60 cycle

300 KW G.E. Syn. 250 volts D.C. 2300 volts A.C.
150 KW Ridgway Syn. 125 volts D.C. 2300 volts A. C.

ROTARY CONVERTERS
3 phase 60 cycle

2500 KW G.E. 250 D.C. 4600 A.C.
1500 KW Wstg. 250 D.C. 2300 A.C.
1000 KW Wstg. 250 D.C. 13200 A.C.
500 KW Wstg. 250 D.C. 2300 A.C.
150 KW Wstg. 250 D.C. 2300/4600 A.C.

SPECIAL OFFERING

2—375 KVA Two unit (156 KVA and 219 KVA) Electric Machinery alternating current generators, 3 phase 60 cycle 240 volts 360 RPM direct connected to Skinner Vertical Universal Uniflow engines, two cylinders' 140-165# steam pressure 0-7# back pressure.

Used only two winters — Excellent condition

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 9514** **CLEVELAND 14, OHIO**

TWO BULLSEYES!

WE OWN WHAT WE ADVERTISE

BELYEA

SUCCESSFUL OPERATION GUARANTEED

WE buy it before you buy it—SO IT HAS TO BE GOOD—and you GET IT QUICKER!

RE NU BILT — BELYEA — MOTORS

Because it's RE-NU-BILT by specialist in Electrical Power Equipment!

"SUCCESSFUL OPERATION GUARANTEED"

MOTOR GENERATOR SETS

3 Phase—60 Cycle

1—1500 KW G.E. 275 V. D.C. to 2100 H.P., 4400/2200 V. Syn. with exciter.
1—400—3 unit with 2—200 KW—GE DC gens. and 700 HP, 2300 v.
1—300 KW—Cr. Wh. 3 unit with 150 KW. 125 v. D.C. gens. and 450 HP—4150 v. Syn.
1—150 KW. GE—250 B. DC to 250 HP—440 V. Ind. Motor.
1—150 KW—Whse. 600 V. D.C. to 200 HP—2200 V.
1—150 KW Whse. 3 unit (2) 75 KW 125 B. Gen. D.C. to 200 HP—2300 V. Ind.
1—150 KW. GE 600 V. d.c. to 225 H.P. 440 V. Syn.
1—85 KW. GE—250 V. DC to 150 HP—440 V. Ind. Motor.
1—75 KW GE 250 V. DC to 125 HP—220 V. Ind.
1—75 KW GE 125 V. D.C. to 120 HP—2300/4000 V. Ind.
1—50 KW GE 125 V. D.C. to 75 HP—2300/4000 V. Ind.
2—48 KW 3 unit with 2—24 KW GE 60 volt D.C. gens. and 60 HP—440 v. Sq. Cg.

SPECIAL

1—500 KW—GE 250 V D C to 700 HP—2300/4150 Syn. Motor—3 phase—25 cycle with Controls.

TRANSFORMERS—60 Cycle

Qu.	Kva.	Make	Ph.	Type	Voltages
1	1050	G.E.	3	WCTH	11000x445/222
4	525	G.E.	1	HJ	2300x445
2	333	Pitts.	1	OISC	2400x220
1	300	Pitts.	3	OISC	4150x208/120
3	200	G.E.	1	HJ	2300x408/204
1	200	G.E.	2-3	Auto	2500x2500
3	100	G.E.	1	HJDD	13200x445/226
3	100	Whse.	1	OISC	13200x250

A. C. GENERATORS

3 Phase—60 Cycle

Qua.	Kva.	Make	Type	R.P.M.	Volts
1	37.5	G.E.	ATI	1200	220/127
1	45	Whse.		514	2300
1	125	G.E.	ATI	900	2300
1	337	Whse.		360	480

A. C. MOTORS

3 Phase—60 Cycle

SLIP RING

Qu.	H.P.	Make	Volts	R.P.M.	Desc.
1	2500	G.E.	6600	253	MT
1	800	Al. Ch.	440	885	ANY
1	600	Cr. Wh.	2200	507	131 AQ
1	600	Whse.	440	400	CW
1	600	G.E.	2200	600	MT
1	350	G.E.	4000/2300	253	MT-442Y
1	250	G.E.	4000	257	MT-424Y
1	225	G.E.	550	720	IM-17
1	60	G.E.	2200	1755	MT-337

SQUIRREL CAGE

1	725	G.E.	13800/2300	600	KT
1	400	G.E.	2200	1175	IE-15B
1	400	Whse.	2200	585	CS-1104
1	300	G.E.	2200	600	IK
1	300	G.E.	440	900	IK
1	250	G.E.	440	600	IK
1	200	G.E.	550	580	IK
1	200	G.E.	2300	1175	IK
1	200	G.E.	440	580	IK
1	200	Al. Ch.	2300	1176	
2	175/112	G.E.	440	900/720	IK
2	150	G.E.	40	1200	K-6325B. Brg
2	150	G.E.	440	600	IK
1	100	G.E.	440	900	IK
1	100	G.E.	2300	450	IK-Vert.

SYNCHRONOUS

2	2100	G.E.	2200/4400	514	ATI
1	700	Whse.	4600/2300	1200	
1	600	G.E.	2300	900	TS
1	125	G.E.	2300	900	ATI

SYNCHRONOUS CONDENSER

1	5000	Whse.	2300/1000	900	

ROTARY CONVERTERS

3 PHASE—60 CYCLE

Qu.	Kw.	Make	Speed	D.C.V.	Trans. V.
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	Whse.	900	600	11000
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300

3 PHASE—25 CYCLE—BOOSTER TYPE

2	1500	G.E.	500	225/275	13200/6600

All units can be furnished with A. C. & D. C. control.

SPECIAL

1—2000 amp., 3 pole, 15000 V Conduit types F-120-15 D, 230 V Sol. operated OCB—1000 000 uninterrupting capacity.

D. C. MOTORS

Qu.	H.P.	Make	Type	Volts	Speed
4	800/1000	Whse.		450	600/750
1	800	G.E.	MPC	550	600
1	700	G.E.	MCF	600	150/525
1	650	G.E.	MPC	250	115/145
1	325	Whse.		230	1050/1250
2	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/550
1	300	G.E.	DMC	230	400/600
2	300	Cr. Wh.	CCM-151H	230	630/700
1	250	G.E.	MPC	230	400/500
1	250	Al. Ch.		230	525
1	135/175	G.E.	MCF	230	450/1050
1	150	G.E.	MPC	230	250/450
1	130	Cr. Wh.	CMC-65H	550	1200
2	125	G.E.	CO-1832	230	625
2	100	G.E.	TLC	250	1050/3500
1	75	Cr. Wh.	100HL	230	350/900
1	75	G.E.	C	230	650/900

TURBO GENERATOR SETS

1—500 KW—Whse. 625 KVA. 440 v. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lbs. condensing turbine with jet condenser and accessories.
1—75 KW Ridgeway 250 V. D.C. with Terry 180 lb. with 12 lb. back pressure, 2000 RPM.

38TH YEAR OF SERVICE

WE OWN WHAT WE ADVERTISE IT HAS TO BE GOOD!

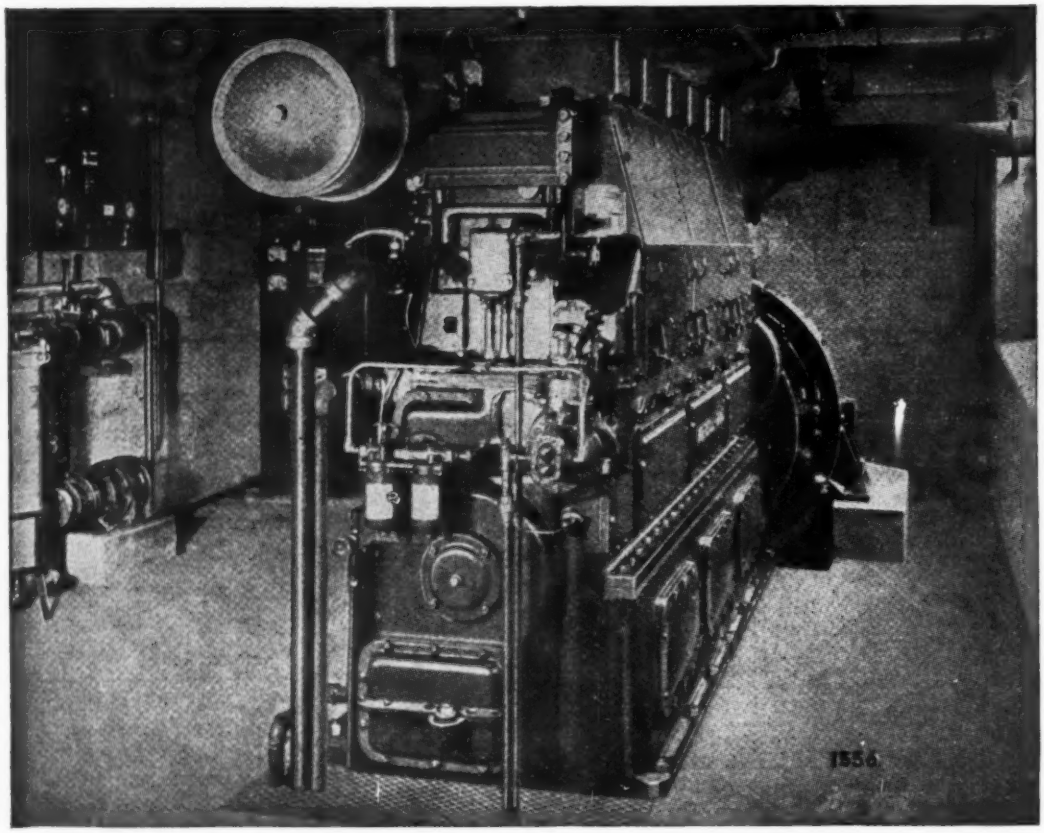
BELYEA COMPANY, INC.

We Buy for Stock — for CASH
What Surplus Do You Have?

PHONE—JOURNAL SQUARE—2-3334
Also
N. Y. CITY — RECTOR 2-7150

Main Office and Shop
43 HOWELL STREET
JERSEY CITY 6, N. J.

DIESEL GENERATORS
DIRECT CURRENT



1—385 HP INGERSOLL RAND DIESEL ENGINE MODEL 'S' 6 CYL., 10½" x 12" DIRECT CONNECTED TO:

1—250 KW GENERAL ELECTRIC TYPE LDR 600 RPM GENERATOR. ALL NEW 1942 —EXCELLENT CONDITION

OTHER DIRECT CURRENT OFFERINGS—IMMEDIATE DELIVERY

KW	VOLTS	MAKE	HP	MODEL	RPM	YEAR
3—500	120/240	General Motors	750	8-278-A	720	New
2—300	120/240	General Motors	450	6-278-A	750	New
6—275	120	Cooper Bessemer	440	FS-8	800	New
2—250	120/240	Enterprise	450	DSG-6	450	New
3—100	120/240	Superior	150	GDB-8	1200	New
1— 90	120	Winton	140	144	1200	1939
2— 60	120	General Motors	90	6-71	1200	1943
3— 15	120	Hill	30	4 C	1200	1940
2— 12	120	Hill	25	4 R	1200	1939
2— 10	120	Hill	20	4 R	1200	1940

WRITE — WIRE — PHONE

80,000 DIESEL HORSEPOWER FOR IMMEDIATE SHIPMENT.

A. G. SCHOONMAKER COMPANY

DIESEL ENGINES
POWER CONSTRUCTION EQUIPMENT

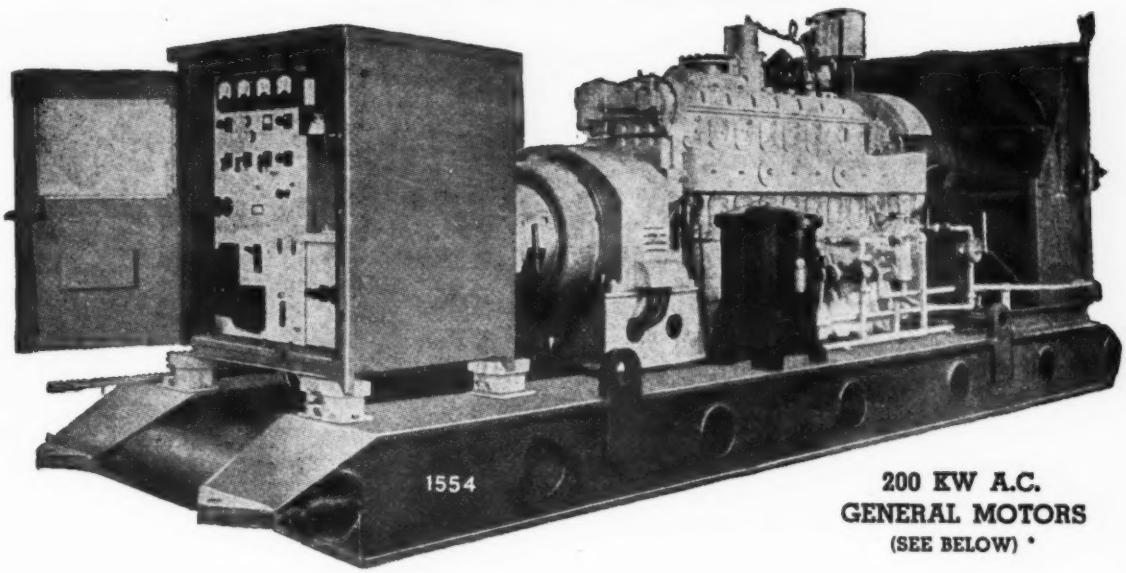
50 CHURCH ST., N. Y. 7, N. Y. *Established 1898*

Phone Worth 2-0455
Cable Address AGSCOMACH

DIESEL GENERATORS

ALTERNATING CURRENT

50 AND 60 CYCLES



200 KW A.C.
GENERAL MOTORS
(SEE BELOW) *

OTHER IMPORTANT OFFERINGS FOR QUICK DELIVERY ! !

KW	MAKE	H.P.	MODEL	RPM	YEAR
2—1500	Fairbanks Morse	2000	33E16	300	1939
1—1000	Nelseco	1500	6M1-53	300	1931
4—1000	General Motors	1600	16-287-A	720	1944
4— 800	General Motors	1200	16-278-A	600	1944
1— 500	Superior	750	OS	327	1938
1— 300	General Motors	450	6-278-A	600	New
1— 250	Enterprise	450	DSG-6	450	1945
1— 240	Fairbanks Morse	360	YVA	257	1928
*4— 200	General Motors	300	8-268-A	900	New
4— 200	General Motors	400	8-268-A	1200	1945
1— 125	Buckeye	190	70	514	1941
4— 100	General Motors	200	3-268-A	1200	1944
1— 75	Buckeye	112	E	400	1936
4— 60	General Motors	90	6061E	1200	New
5— 50	International	75	UD18	1200	New
10— 30	International	45	UD14	1200	New

80,000 DIESEL HORSEPOWER FOR IMMEDIATE SHIPMENT

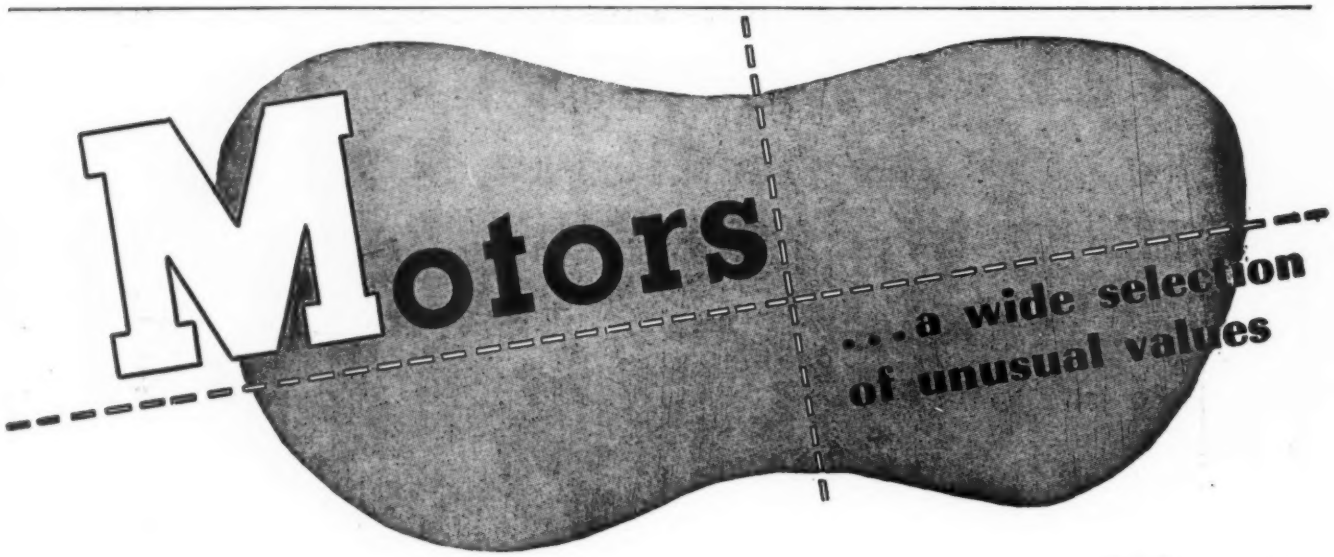
WRITE FOR BULLETIN

A. G. SCHOONMAKER COMPANY

DIESEL ENGINES
POWER CONSTRUCTION EQUIPMENT

50 CHURCH ST., N. Y. 7, N. Y. *Business Est. 1898*

Phone WOrth 2-0455
Cable Address Agscomach.



Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 220/440 Volt.

Qu.	HP	Make	Type	Speed
1	150	Al. Ch.		1750
1	100	R'way 440v.		1200
1	100	West. 2200v.	CCL	1720
1	100	G.E.	I	340
1	100	G.E.	I	290
1	75	Lincoln	C10	1200
1	75	Lincoln	IQ	600
1	75	G.E.	KT562	450
6	75	G.E. 440v. new Ball Bearing	K	1800
1	50	G.E.	I	720
2	50	West.	MS 25 cy.	720
1	50	Wag.	BM	495
1	50	Al. Ch.		490
1	40	Triumph	B12	850
2	35	Al. Ch.	2 ph.	865
2	35	Al. Ch.		865
1	35	Ft. Wayne	2 ph.	900
1	35	G.E.	25 cy.	730
1	30	F.M. 2200v.	HD12B	3600
1	30	Al. Ch.		1200
1	20	Louis A.	KH	1170
1	30	West.	CCL	900
1	30	Wagner	22VBR	860
2	30	Al. Ch.	AN 2 ph.	860
1	30	Century	AS 25 cy.	720
5	30	West. new B.B. 440v.		1750
7	25	West. new B.B. 440v.		1160
6	25	G.E. B.B. 440v.		1160
1	25	R. & M.	K207	1750
1	25	Howell		1200
1	25	Lincoln		900
1	25	G.E.	KT332	900
1	25	Al. Ch.		860
1	25	Rel. (elevator) T.E.		750
1	25	Al. Ch.		720
1	25	G.E.	M10	720
1	25	West.	CS644C	690
1	20	West.	CCL	3600
1	20	Al. Ch.		1700
1	20	Century		1740
1	20	F. M.	KRV	1200
1	20	West.		1200
1	20	Wagner		1150
1	20	Ideal	A	1150
2	20	Wagner	HRP404	1060
1	20	Cleve.	M-147	900
1	20	Al. Ch.		860
1	20	R. & M.	K-207	900
1	20	West.	CS-644	870
1	20	West.	M8	900
1	20	F. M.	H	870
1	20	West.	CCL	580
1	20	Wagner	CM	445
1	18	West.	MS-4(Elev.)	720
1	15	West.	CCL	1700
1	15	Cr. Wh.	115Q	1720
1	15	Wagner	15TCP-TEFC	1140
2	15	West.	CS-573 25 cy.	725
2	15	West.	MS 25 cy.	725
1	15	West.	CS567C 25 cy.	715
1	15	West.	MS 25 cy.	600
1	10	West.	CS 25 cy.	725
1	10	West.	MS 25 cy.	720
2	10	West.	CS473C 25 cy.	615
1	7½	Wagner	MCP-365	1140
1	7½	Lima	RS-405 b.b.	514

SLIP RING

3 Phase, 60 Cycle, & Syn.

Qu.	HP	Make	Type	Speed
1	443	El. Mach.		900 Syn.
1	200	F.M.	BV	600
1	200	Westg. 2200v.		600 Syn.
2	75	F.M. 2200v.	BV-H16B	1800
1	75	G.E.	MT552	865
1	50	G.E.	IM	1150
1	50	Triumph	C12	1150
1	50	G.E.	IM	900
1	50	G.E.	IM 25 cy.	700
1	50	Al. Ch.		690
2	40	G.E.	MT336	1200
1	40	Al. Ch.		1160
1	40	W'g 2200v.	CW	870
1	40	Westg.	CW-658-A	870
2	40	Al. Ch.		870
1	40	G.E.	MY-W	880
1	40	Westg.	C1753A 25 cy. cr.	730
10	35/15	G.E.	OMT336	1150/550
1	35	Al. Ch.	25 cy.	720
2	35	G.E.	IM	870
1	30	F. M.	AD Alt.	1200
1	20	Imperial	DW-D37	1800 Syn.
1	22	G.E.	ITC5011 (hoist)	680
1	25	Westg.	MW 322A	680
1	25	G.E.	MT342	600
1	25	G.E.	MT356	400
1	20	Triumph	C10	1200
2	15	G.E.	MT302	1200
1	15	G.E.	MT332	720
1	15	Westg.	CS	585
1	15	G.E.	MT556	280
3	10	Westg.	CW464A	1200
1	10	Westg.	HF	1140
1	10	W. E.		1200
1	10	G.E.	IM	1200
1	7½	G.E.	MT182	1750
1	7½	Westg.	CW-452A	1200
8	½	G.E.	MT926 slip ring	1800

DC—230 Volt

Qu.	HP	Make	Type	Speed
1	75	Diehl	K11	700
1	100	G.E.	CD123	1200
1	60	Westg. 115v.	SK140L Vert.	1140
1	60	G.E.	EFI	1200
1	40	Rel. 440v.	13LT Vert.	1750
1	40	Rel. 440v.	230T Vert.	1130
1	25	C.W. 440v.	CMC-EH Vert.	1150
2	40	Westg.	SK 123	1150
3	40	G.E.	RC 32	1100
8	40	Westg.	SK 140	775
1	35	R. C.	11B	1500
1	35	Al. Ch.		1200
1	35	G.E.	DLC 203	700
1	35	Westg.	SK 163 Vert.	300/1200
1	30	El. Dy.	158	625
1	30	Westg.	SK 110L	1150
1	30	Rel. 440v.	131 T Vert.	1150
4	30	Reliance	92 TF	1750
1	27½	G.E.	CVC 116	1750
10	25	Westg.	SK 120	825
3	25	Westg.	SK 103	1150
1	25	Westg.	SK 90	1400
4	25	Westg.	SK 100 L	1150
1	30	G.E.	RC 51B	1150
1	25	Sprague		850/2000
1	25	Westg.	SK 123	550/1100
1	25	Al. Ch.	E 120	500/1500
1	25	G.E.	RF 12	400/1200
2	25	Westg.	SK	400/1200
1	25	J. & L.		625
2	20	Reliance	131T	1000
2	20	Diehl	K914A	500/1500
2	20	Westg.	SX113	500/1500
1	20	G.E.	RF12	250/1000
1	20	Lincoln	FXW B.B.	1800
1	20	Westg.	SK70L	1700
6	20	Cr. Wh.	CMC T.E.B.B.	1750
1	20	Cr. Wh.	CMC T.E.B.B.	1150
1	20	Westg.	SK93	1150
11	20	Reliance	92T	1150
1	20	Westg.	SK120 T.E.	1100
3	20	Westg.	SK 100L	900
1	20	Watson	K	850
3	20	Reliance	131T	850
1	20	G.E.	RC30	750
1	20	Westg.	SK110L-115V	750

DC—230 Volt

Qu.	HP	Make	Type	Speed
4	20	Westg.	SK110L	750
1	20	Cr. Wh.	CW-CMC	600
1	20	Westg.	SK120	500
3	20	Al. Ch.	K	500/100
1	15	Reliance	46TF	1750
2	15	Westg.	SK63	1750
1	15	Westg.	SK113 encl.	1750
1	15	G.E.	RC29A	1700
1	15	Westg.	SK93	1150
4	15	Westg.	SK83	1150
4	15	Cr. Wh.	CW-CCM T.E.	1150
1	15	Westg.	SK70L	1250
1	15	G.E.	CD83	1150
1	15	G.E.	RC10	1150
1	15	G.E.	RC29	1150
4	15	Westg.	SK93	850
4	15	Reliance	92TF	850
4	15	R. & M.		1000
1	15	G.E.	CVC-115	925
6	15	Westg.	SK90 Vert.	825
1	15	G.E.	RC29	750
6	15	Westg.	SK110L	675
1	15	Al. Ch.		1075
8	15	Reliance	131T	550
3	15	Reliance	92T	850/1700
1	15	Reliance	66T	800/1600
1	15	Westg.	SK	500/1500
2	15	Westg.	SK110L	400/1600
1	15	Triumph	32F	300/600
1	15	Triumph		225/900
1	12½	Westg.	SK	750/1500
7	10	Westg.	SK70	850
2	10	G.E.	RC29	850
2	10	Reliance	66TF	850
20	10	Westg.	SK60L-SK60-Reliance 46TF	1150
10	10	Cr. Wh.	CM CHB T.E.B.B.	1750
4	10	Westg.	SK43	1700
1	10	G.E.	RF11	600/2400
4	10	G.E.	RF10	600/1800
6	10	Westg.	SK80L	500/1500

DC—230 Volt

Qu.	HP	Make	Type	R.P.M.
23	10	Al. Ch.		800/1000
1	10	G.E.	RF10	400/1200
2	10	Kimble	BA324 new B.B.	1750
1	10	Westg.	SK91	250/1000
21	7½	Westg.	SK33	1750
16	7½	Westg.	SK43	1150
20	7½	Westg.	SK60	850
20	5	Westg. & G.E.		1750
60	5	Westg. Rel.		1150
50	5	Westg.	SK43	508
75	3½	Westg.	SK33	850
80	3	Westg.	CD925	1725
120	3	Westg.	SK20	1550
60	2	Westg.	SK & CD	1150
50	2	Westg.	SK20	850
40	1½	Westg.	CD	1150
30	1½	Westg.	CD925	550/2200

2—200 KW, Westinghouse, 2200 to 250 Volt, DC, latest type variable voltage, 900 RPM, M-G sets, complete with control.

2—150 KW new, ball bearing, 440/250 Volt DC, 1200 Westinghouse M-G sets

1—150 KW, 440/250 Volt DC General Electric M-G set

The **Wente** *Electric Co.*

Hamilton, Ohio

Rebuilt Motors & Generators

Since 1906

FOR SALE—IMMEDIATE DELIVERY

POWER PLANT EQUIPMENT

TURBINE-GENERATOR UNITS
3 Phase, 60 Cycle

6250 KVA Allis non-condensing, 450 lbs. pressure, 725° TT, 185 lbs. exhaust 4500 volts, 3600 RPM.

4375 KVA G.E. condensing, 2300 volts, 3600 RPM, 200 lbs. pressure equipped with condenser.

4000 KVA Allis condenser, 200 lbs. pressure, 600 volts, 3600 RPM equipped direct connected exciter and surface condenser.

3750 KVA G.E. condensing, 200 lbs. pressure, 500° TT, 2,300 volts, 3600 RPM complete with surface condenser and switchboard.

2500 KVA G.E. condensing, 150 to 200 lbs. pressure, 2300 or 550 volts, 1800 RPM complete surface condenser, exciter and panel.

2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, 3600 RPM, complete surface condenser, exciter, switchboard.

1875 KVA Westinghouse condensing, 175 to 200 lbs. pressure, 500° TT, 480 volts, 3600 RPM, complete with turbine driven exciter set, switchboard, Westinghouse jet condenser and condensing auxiliaries.

1563 KVA Allis non-condensing, 150 to 200 lbs., 15 to 25 lbs. gauge back pressure, 480 volts, 3600 RPM equipped with direct connected exciter and panel.

1250 KVA Westinghouse non-condensing, 200 to 250 lbs. pressure, 500° TT, 15 lbs. gauge back pressure, 480 volts, 3600 RPM, complete with exciter, switchboard panel.

1250 KVA Westinghouse condensing, 2400 volts, 3600 RPM, 200 lbs. pressure, equipped with direct connected shaft exciter, condenser, switchboard and instruments.

375 KVA G.E. condensing, 150 to 200 lbs. pressure, 100° SH, 2300 volts, 3600 RPM, complete with surface condenser and auxiliaries.

250 KVA G.E. non-condensing, 240 lbs. pressure, 5 lbs. gauge back, 220 volts, complete with exciter and switchboard.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. gauge back, 240 volts with direct connected exciter and switchboard.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete with switchboard.

100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM complete.

ENGINE-GENERATOR UNITS
3 Phase, 60 Cycle
Alternating Current

750 KVA G.E. 2300 volts, 150 RPM generator direct connected 28" x 32" Chuse Unaflow poppet valve engine.

575 KVA General Electric, 460 volts, 150 RPM generator direct connected to 24" x 36" Nordberg Unaflow engine, 150 to 175 lbs. pressure, 10 to 40# back pressure.

500 KVA Westiinghouse, 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10-lbs. gauge back pressure. Complete Installation.

500 KVA G. E. 2300 volt generator direct connected to Chuse Unaflow non-condensing engine.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator, direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lbs. pressure, 6 lbs. back pressure.

300 KVA G. E. 2300/480/240 volts, 200 RPM generator direct connected to Skinner Unaflow non-condensing engine—Complete.

225 KVA E. M. 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back pressure.

150 KVA G.E. 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.

ENGINE-GENERATOR UNITS
Direct Current

300 KW Allis-Chalmers, 250 volts, 150 RPM generator direct connected to 24" x 28" Chuse Unaflow non-condensing engine, 130 to 150 lbs.

125 KW, 125 volts, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lbs. pressure, 10 lbs. back pressure, complete with switchboard.

75 KW Westinghouse, 125 volt, 1800 RPM non-condensing turbine generator unit.

75 KW Allis-Chalmers Terry, 125 volt-2400 RPM non-condensing turbine-generator unit.

15 KW (2) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to an American Blower vertical engine.

SPECIAL OFFERINGS

125 KVA (8), 3 phase, 60 cycle, 480 volts, 514 RPM Electric Machinery horizontal synchronous generators. NEW.

500 KVA Westiinghouse, 3 phase, 60 cycle, 600 volts, 514 RPM belted generator.

750 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts alternating current generator, direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

1000 KW, 250 volt direct current—6 phase, 60 cycle, 514 RPM Westinghouse booster type rotary converter complete with transformers.

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

3480 sq. ft. Allis surface condenser.

6000 sq. ft. C. H. Wheeler surface condenser.

1—10 Ton Brown Hand operated crane with 31'0" span, approximately 150 ft. 15" I beam with 6" wide flange.

1—ALLIS-CHALMERS SYNCHRONOUS MOTOR GENERATOR SET CONSISTING OF: 1500 KW 550/600 volts, 300 RPM compound wound interpole direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM, A.C. motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

FOUR AIR COMPRESSORS

Available for Immediate Shipment

1—1856 CFM, 100# pressure, 23x13x14 Chicago Pneumatic, Class OCE, 2 stage Air Compressor, direct driven by 300 H.P. 3 ph. 60 cyc. 2300 v. 277 RPM Synchromous Motor, complete with 5 stage automatic starter and MG Set Exciter, after cooler, air filter, 54" x 14' air receiver.

New in 1944—used 10 months

3—1240 CFM, 100# pressure, Ingersoll Rand XRE-2, 19½x12x12 Air Compressors, each driven by 200 H.P., 3 phase, 60 cycle, 2200 volt, 300 RPM Synchronous Motor, complete with panelboard and after cooler

New 1943—used 18 months

TURBO-GENERATORS – MOTORS – WELDERS

1—5000 KW Westinghouse Turbo-Generator, 3600 RPM, 200# pressure, condensing, 2300/3/60 complete

1—710 HP Terry Turbine, 3600 RPM, 145# ISP, 0–60# BP, 18" x 18" centrifugal pump rated 13,000 GPM, 170' head, 1000 RPM

1—50 KW Westinghouse Turbo-Generator, 200# pressure, 75 HP, 7200 RPM, geared to 50 KW, 125 V DC 1200

1—800 KW Westinghouse M-G set, Synchronous Motor, 1150 HP, 514 RPM, 13200/60/3. Generator 250 V DC with direct connected exciter

1—300 KVA Generator Set, Burke Alternator, 480/60/3, 200 RPM, direct connected to Exciter and Skinner Uniflow, 150# ISP, 0–5# BP

1—1000 H.P. General Electric Slip Ring Motor, 6600/60/3, 600 RPM, with controls

1—700 H.P. General Electric, Type KF motor, 2300/60/3 1800 RPM

1—150 KW General Electric Alternator, Type ATB, Form B, .8 PF, 480/60/3 600 RPM, 3 bearing, direct connected exciter

300 and 400 Ampere

MOTOR DRIVEN ARC WELDERS

General Electric - Hobart - Lincoln

Purchased in 1943—Reconditioned

Used less than 1 yr.

300 AMPERE GASOLINE ARC WELDERS

Hobart, Durac, P&H, Star

Driven by six cylinder Chrysler engine

MISCELLANEOUS

1—25-ton Carrier Air-Conditioning Unit, Complete including Kathabar unit. Installed new in 1944. Used one season

1—3600 sq. ft. Wheeler Surface Condenser

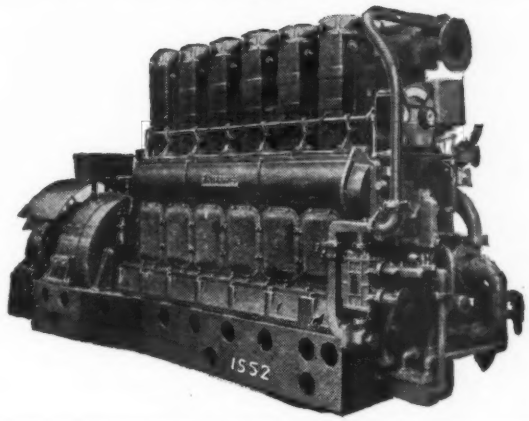
2—12" LeCourtney Centrifugal bronze fitted pumps, 1800 RPM

1—20-ton Box Crane, hand operated, 39 ft. span, complete

Heat and Power
COMPANY

70 PINE ST. WHITEHALL 3-2172 **NEW YORK 5, N. Y.**

DIESEL POWER



4—250 KW Diesel Generators, 3-Direct Current 120/240 volt, 3-wire

1—Alternating Current, 3 phase, 60 cycle, 2300 volt

Each direct connected to

4—450 HP Enterprise, diesel engines, Type DSG-8, 450 RPM, 6 cylinder, 12" bore x 16" stroke

OTHER IMPORTANT DIESEL POWER OFFERINGS FROM STOCK

GENERATOR SETS
ALTERNATING CURRENT

1500 KW FAIRBANKS MORSE	2300 V
1000 KW NELSECO	2300 V
500 KW SUPERIOR	2300 V
350 KW DE LA VERGNE	2300 V
300 KW GMC	127/220 V
300 KW NELSECO	2300 V
280 KW McINTOSH & SEYMOUR	240 V
250 KW McINTOSH & SEYMOUR	240 V
250 KW ENTERPRISE	2300 V
240 KW FAIRBANKS MORSE	2400 V
130 KW FAIRBANKS MORSE	2400 V
125 KW BUCKEYE	240 V
100 KW SUPERIOR	240 V
75 KW BUCKEYE	240 V
50 KW INTERNATIONAL	127/220 V
30 KW INTERNATIONAL	127/220 V
15 KW INTERNATIONAL	127/220 V

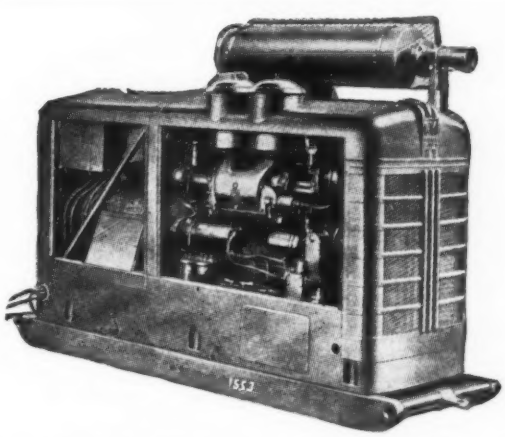
GENERATOR SETS
DIRECT CURRENT

250 KW ENTERPRISE	120/240 V
60 KW GMC	120 V
60 KW BUDA	120 V
15 KW HILL	250 V
15 KW HILL	120 V

PORTABLE POWER UNIT

150 HP BUDA	1200 RPM
130 HP CATERPILLAR	1000 RPM
100 HP INTERNATIONAL	1200 RPM
65 HP INTERNATIONAL	1200 RPM
60 HP FAIRBANKS MORSE	1200 RPM
43 HP INTERNATIONAL	1200 RPM
30 HP INTERNATIONAL	1200 RPM
18 HP LISTER	1200 RPM
15 HP GENERAL MOTORS	1200 RPM

ALL EQUIPMENT AVAILABLE FOR IMMEDIATE DELIVERY



60 KW A.C. GMC DIESEL GENERATOR SET

NEW

60 KW General Electric Generator — 3 phase 60 cycle 127/220 volt. 1200 RPM—direct connected to—

90 H.P. General Motors Corp. Model RC-38 4¼" Bore x 5' stroke. Complete with Radiator Switchboard and Auxiliaries—

Immediate Delivery—In Stock—

ADVISE US OF YOUR POWER REQUIREMENTS

WRITE WIRE PHONE

A. G. SCHOONMAKER COMPANY

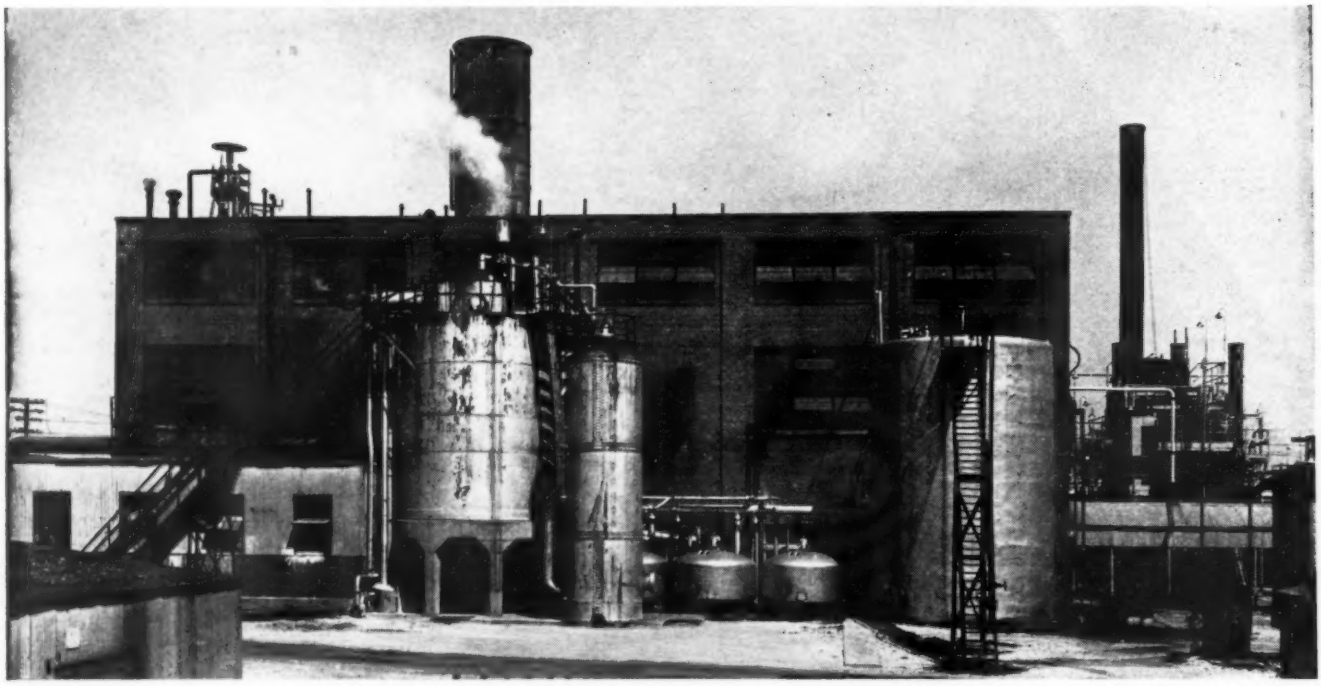
DIESEL ENGINES

POWER & CONSTRUCTION EQUIPMENT

50 CHURCH ST., N. Y. 7, N. Y. *Business Est. 1898* ***Phone:* WOrth 2-0455**

POWER PLANT FOR SALE

We have recently purchased from the Humble Oil & Refining Company their Ingleside Refinery at Ingleside (near Corpus Christi), Texas. Included in this refinery is a complete power plant which was in operation until May 15th.



Below Is a Partial Inventory — Complete in Every Respect

- 4 HIENE BOILERS
- 1 RILEY BOILER
- EXCITERS
- TRANSFORMERS
- COOLING TOWER
- 2—3000 KW G. E. TURBINE GENERATORS
- COMPLETE CONDENSATE PUMPS
- COMPLETE WATER PUMPS
- PANEL AND SWITCH BOARDS
- WATER PURIFICATION SYSTEM

THIS PLANT IS TO BE SOLD *AS A COMPLETE UNIT* ON A "AS IS AND WHERE IS" BASIS. INTERESTED PARTIES MAY CONTACT US FOR ANY INFORMATION, WHICH WILL BE GLADLY FURNISHED, AND INSPECTION IN COMPANY WITH OUR ENGINEER CAN BE ARRANGED AT YOUR CONVENIENCE! THIS IS A RARE OPPORTUNITY TO OBTAIN A COMPLETE POWER PLANT, INCLUDING SPARE PARTS, READY FOR IMMEDIATE OPERATION.

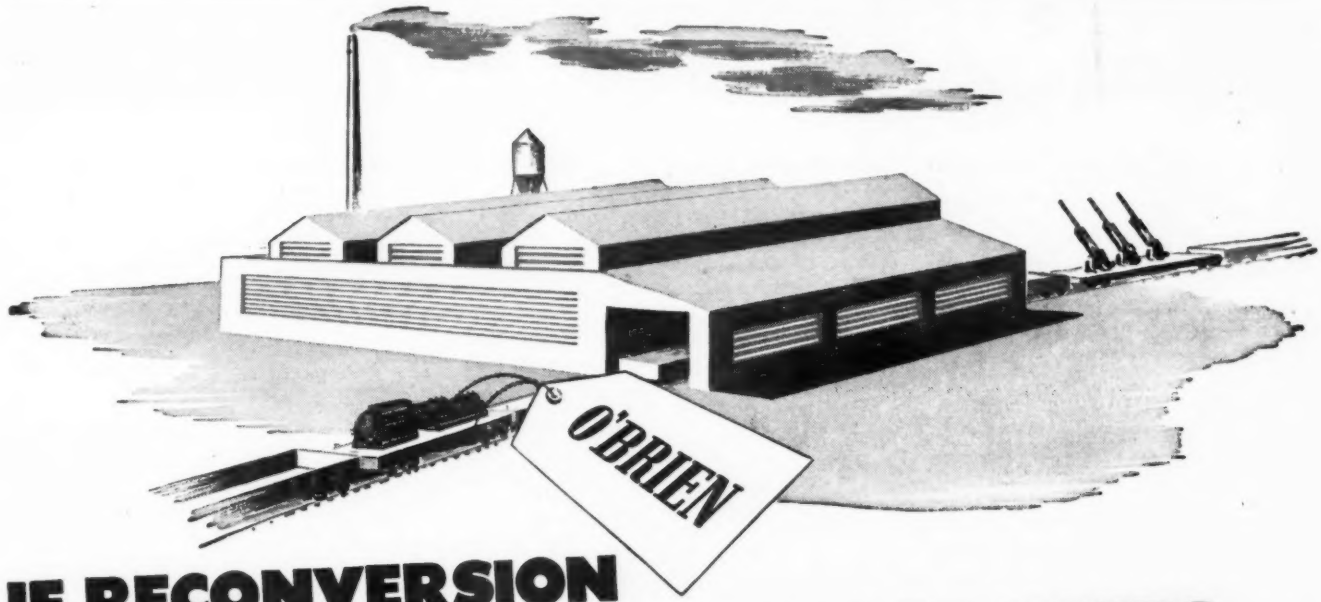
Telephone, Telegraph or Write

SAMPSON MACHINERY & SUPPLY COMPANY

INGLESIDE, TEXAS

Telephone No. 6 (Near Corpus Christi) **P. O. Box 995**

MAX CLAIRFIELD, MANAGER



IF RECONVERSION CHANGES YOUR POWER NEEDS . . .

IT'S a matter of availability, speed, service and economy when you make equipment changes to meet new power requirements. You can easily solve this four-way problem by putting it up to O'BRIEN. We carry *in stock* a wide line of well known makes of new machinery for immediate shipment. Our engineers will gladly help you apply and adapt the equipment to your specific needs.

If economy is your primary consideration, keep your capital investment to a minimum with O'BRIEN *rebuilt* power plant equipment. Rebuilt the O'BRIEN way means *completely* rebuilt, thoroughly tested and guaranteed. O'BRIEN facilities include extensive shops as well as steam and electrical testing facilities comparable to those of leading manufacturers. Exact testing under load conditions before shipment is your assurance of getting completely overhauled machinery into which we've built many extra years of useful life.

If your problem is disposal of surplus equipment or an entire plant, O'BRIEN can help you here, too. For we are constantly seeking machinery of all types to meet the growing demands of our customers. Remember, you can buy from or sell to O'BRIEN with the same degree of confidence. And this service is just as close as your telephone!

NEW—USED—GUARANTEED REBUILT MACHINERY CARRIED IN STOCK FOR PROMPT SHIPMENT

POWER PLANT EQUIPMENT: Turbo Generators • Engine Generators • Diesel Engines Boilers • Motor Generator Sets • Electric Motors • Air Compressors • Pumps • Heaters • Complete Power Plants • **METAL-WORKING MACHINERY:** Machine Tools of All Kinds • Pipe Machines • Punches • Shears • Welders • Presses and Forging Equipment.

REPRESENTATIVES IN PRINCIPAL CITIES OF THE WORLD

Everything From a Pulley to a Powerhouse

THE O'BRIEN MACHINERY CO.

T.M. REGISTERED U.S. PATENT OFFICE

Bell Telephone: MARKET 4180 — PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS — Cable Address: OBRIEN PHILA

113 NORTH THIRD STREET • PHILADELPHIA 6, PA., U. S. A.

AFFILIATED WITH

SOC EXPANSÃO INDUSTRIAL SUL AMERICANA LTDA

RIO DE JANEIRO — BRASIL

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

1—22500 KW General Electric Cond.
1—15300 KVA Westinghouse Cond.
2—12500 KW General Electric Cond.
1— 7500 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 3750 KVA Westinghouse Extras.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA General Electric Cond.
1— 1875 KVA Westinghouse Cond.
1— 1563 KVA Westinghouse Extras.
1— 1250 KVA General Electric Extras.
1— 375 KVA General Electric Cond.
1— 6250 KVA Allis Chalmers Topping
1— 1875 KVA Westinghouse Non-C.

D. C. TURBO UNITS

1—250 KW Westinghouse, 120/240 V.
1—125 KW General Electric, 125 V.
1— 75 KW General Electric, 125 V.
1— 50 KW Westinghouse, 125 V.

STEAM ENGINE UNITS—60 Cy.

1—900 Hamilton Uniflow
1—625 KVA Ames Uniflow
1—600 KVA Chase Uniflow
2—400 KVA Skinner
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—300 KVA Skinner Uniflow
1—150 KVA Ames Uniflow

WATER TUBE BOILERS

2—1409 HP B. & W. 650-lb., Stokers
1—1373 HP B. & W. 230-lb., Oil Fired
1—1320 HP Springfield 400-lb., Pulverizer
1— 607 HP Wickes 250-lb., Stoker
2— 600 HP Springfield 200-lb., Stokers
2— 560 HP Erie City 460-lb.
5— 492 HP Heine 180-lb., Stokers
2— 481 HP Springfield 225-lb., Pulverizer
2— 469 HP B. & W. 425-lb., Pulverizer
2— 323 HP Springfield 225-lb., Stokers

D. C. STEAM ENGINE UNITS

1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—250 KW Ames Uniflow 250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire

DIESEL ENGINE UNITS

1—625 HP Worthington, 240 V. 60 cy. gen.
1—440 HP Nordberg, 250 V. gen.
2—400 HP LaRoi RXISV (gasoline) eng. only
1—375 HP McInt. & Sey., 240 V. 60 cy. gen.
1—300 HP McInt. & Sey., 480 V. 60 cy. gen.
2—250 HP Gen. Motors, 460 V. 60 cy. gen.
1—150 HP Buckeye 400 RPM engine only

SYNCHRONOUS MOTORS

1—300 HP West. 60 cy. 2300 V. 720 RPM
1—300 HP G. E. 60 cy. 2200 V. 1800 RPM
1—200 HP Ideal 60 cy. 4000 V. 514 RPM
2—200 HP Burke 60 cy. 2300 V. 600 RPM
1—100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)
1—100 HP G. E. 60 cy. 4000 V. 1800 RPM

INDUCTION MOTORS—60 Cy.

1—1000 HP West. slip ring 2200 V. 360 RPM
1— 700 HP G. E. sq. cage 2200 V. 1800 RPM
1— 500 HP G. E. slip ring 2200 V. 1800 RPM
1— 500 HP West. sq. cage 2200 V. 1800 RPM
1— 500 HP G. E. slip ring 2200 V. 3600 RPM
1— 400 HP G. E. sq. cage 2200 V. 600 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
1— 250 HP F.-M. slip ring 220 V. 1800 RPM
2— 120 HP G. E. sq. cage 220 V. 3600 RPM

MOTOR GEN. SETS—60 Cy.

1—1000 KW General Electric 600 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 150 KW General Electric 125 V. DC
1— 100 KW Westinghouse 125 V. DC
1— 50 KW Westinghouse 250 V. DC

ROTARIES—60 Cy.

2—2500 KW General Electric 300 V.
1—2000 KW General Electric 600 V.
2—1750 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
1— 500 KW General Electric 250 V.

FREQUENCY CHANGERS

1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
2—1500 KW West. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1—1000 KVA Al. Ch. 25/62½ cy. 375 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

4— 6667 KVA G. E. 79660/138,000-34500 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
4— 1500 KVA G. E. 66-13.2/4.6/2.3 KV
3— 750 KVA Pitts. 66000-33000 V.
3— 100 KVA G. E. 66000-6900/11000 V.
2— 7500 KVA G. E. 33000-13800 V. 3 ph.
4— 1500 KVA G. E. 33-13.2/4.6/2.3 KV
6— 100 KVA G. E. 33000-2300 V.
3— 75 KVA Moloney 33000-2300 V.
2—10000 KVA West. 26400-4560 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
1—10000 KVA West. 13200-4560 V. 3 ph.
2— 1000 KVA G. E. 11500/23000-575 V.
3— 500 KVA Pitts. 6600-2300 V.
3— 150 KVA G. E. 4150-220 V. 3 ph.
3— 250 KVA Al. Ch. 2300-230/460 V.
3— 30 KVA West. 440-220/110 V.
4— 25 KVA West. 440-220/110 V.

OIL CIRCUIT BREAKERS

1— 400 A. 37 KV G. E. FK0136	Outdoor
2—1000 A. 30 KV Kelman GB76	"
1— 400 A. 25 KV G. E. FK-136	"
4— 600 A. 15 KV G. E. FHK0139-2	"
1— 600 A. 15 KV G. E. FK037	Pole Type
1— 600 A. 15 KV West. O-221	Outdoor
2— 400 A. 15 KV G. E. FHK0136	"

PARTIAL LIST — WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7, New York

ELECTRICAL EQUIPMENT

REBUILT AND GUARANTEED—PROMPT SHIPMENT

MOTORS - GENERATORS - MG SETS - TRANSFORMERS - CONTROLS

SPECIAL OFFERINGS

VARIABLE VOLTAGE DRIVES

8—40 HP, General Electric Variable Voltage Ward Leonard Drives consisting of:

1—40 KW, 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators with exciters.

1—40 HP, 250/1500 RPM, Type CD-1441 DC Motor.

2—Auxiliary, 5 HP, 1750 RPM Type B-284 DC Motors.

1—Enclosed magnetic control providing jog forward, jog reverse, run, fast, slow, and stop. Complete with motor operated field rheostat

NEW 21—Leland, 2.5 KVA, 120 Volt, 1800 RPM, 60 cycle, Single Phase, Type AG, Frame 50, Form BOWJH, Continuous, self-excited A-C Generators.

NEW **500 VOLT ADJUSTABLE SPEED D.C. MOTORS**

Qu.	H.P.	Speed	Make	Type
4	7½	450/1800	G.E.	CD-85 (1 Hr.)
4	60	400/1600	G.E.	CD 1446-AL (1 Hr.)

NEW 25—Allis-Chalmers, 10 H.P., 1200 R.P.M., 230 Volt, D.C., EB-80, Dripproof, 40°, Ball Bearing.

NEW 20—Westinghouse 12.5 HP, 600 RPM, 230 volt, DC Marine Type SK-93, Totally Enclosed, Ball Bearing.

NEW 1—200 HP, 2960 RPM, 3 phase, 50 cycle, 500 Volt, Westinghouse Type CS-8120 TEFC
2—250 HP, 296 RPM, 3 phase, 50 cycle, 220/380 Volt, (or 360 RPM, 3 phase, 60 cycle, 440 volt) Westinghouse Wound Rotor Type CW-20-53-15

NEW TRANSFORMERS

3—Moloney, 10 KVA, Type CL-2, Continuous 55°, 2400/4160 Volts Primary 120 Volts Secondary, Single Phase, 60 Cycle, OISC, Outdoor, With 2 High Voltage Bushings and Taps.

ENCLOSED HEATING CONTROLS

3—General Electric CR 2604-H1, 105 KW, 220 volt control, 275 ampere, 3 phase, 60 cycle.
1—General Electric CR 2604-H2, 52 KW, 220 volt control, 135 ampere, 3 phase, 60 cycle.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. — CLEVELAND 14, OHIO
Established 1900 — Phone: ENdicott 5656

BOILERS

NEW and USED

All makes & sizes for prompt shipment several attractive assorted sizes.

SPECIAL OFFER
400-HP . . . 175 lbs. Stirling Boilers
3—250 HP Heine Water Tube Type

J. F. DAVIS CO.

122 S. Michigan Ave. CHICAGO
Telephone Harrison 0755

TURBO GENERATORS

1—1250 KW General Electric Turbo-Generator, Type ATB, Form HT, 3600 RPM, direct-connected exciter, Wheeler Jet Condenser.

1—2000 KW General Electric Turbo-Generator, 180 lb. pressure, 3600 RPM Generator, Type ATB, 600 Volt AC, 2403 Amp. with Westinghouse-LeBlanc Jet Condenser.

1—1500 KW Westinghouse Turbo Generator with Surface Condenser 4200 sq. ft.

Republic Textile Equipment Co.

40 Worth Street, New York 13, N. Y.
Phone: COrtlandt 7-1591

AVAILABLE IN OUR STOCK!

DEPENDABLE GUARANTEED ELECTRICAL EQUIPMENT

SQUIRREL CAGE MOTORS

H.P.	R.P.M.	Volt	Make
75	720	440	G. E.
100	695	440	G. E.
125	1800	220	A. C.
125	1200	2200	A. C.
150	720	2200	West.
150	600	440	G. E.

SLIP RING MOTORS

H.P.	R.P.M.	Volt	Make
30	900	220	G. E.
30	900	2200	F. M.
30	1200	440	West.
30	1200	440	Wagner
30	1200	220	G. E.
40	870	2200	A. C.
40 (2)	1800	2200	West.
75	1200	440	G. E.
75	600	440	West.
110	450	440	G. E.
200	1800	220/440/2200	G. E.
300	600	440	West.

SYNCHRONOUS MOTORS

H.P.	R.P.M.	Volt	Make
300	150	4000/2300	G. E. eng. type.
40	1200	2300/4160	Elec. Mach. Co

D. C. MOTORS

H.P.	R.P.M.	Volt	Make
5	1700	230	Wood
7½	1275	230	Garwood
7½	1150	230	G. E.
10	400/1200	230	West.
10	400	230	G. E.
10 (2)	630	230	West.
10	825	230	G. E.
10	900	230	A. C.
10	1400	230	Wood
15	1300	500	G. E.
15 (2)	700	230	G. E.
25 (2)	650	230	G. E.
25	750	230	G. E.

VERTICAL MOTORS

SQUIRREL CAGE

30 hp 1800 rpm 3/60/220 Fairbanks-Morse solid shaft
15 hp 1800 rpm 3/60/220 G.E. solid shaft

7½ hp 3600 rpm 360/220 Fairbanks-Morse hollow shaft

5 hp 3600 rpm 3/60/230 Westinghouse solid shaft

5 hp 1200 rpm 3/60/230 Ideal solid shaft

SLIP RING

35 hp 900 rpm 3/60/550 Allis-Chalmers solid shaft

DIRECT CURRENT

3 hp 850 rpm 230 v. Watson solid shaft

3 hp 1200 rpm 230 v. Imperial solid shaft

2 hp 1200 rpm 115 v. Louis Allis solid shaft

COMPLETE POWER PLANT BOILERS AND TURBINES

3—728 hp Erie City vertical water tube boilers. 180 lbs. working pressure. 2 Drum Type No. 4 "S". Recommended for 200% load. Each with 125 ft. steel stack and smoke hood. Good condition.

1—G. E. 1250 KVA 3600 rpm 3/60/2300 condensing turbogenerator 175 lbs. gauge with C. H. Wheeler 2 pass surface condenser with all accessories.

1—G. E. 750 KVA 3600 rpm 3/60/2300 condensing turbogenerator 175 lbs. gauge with Westinghouse 2 pass surface condenser with all accessories.

Complete switchboard — generator panels and 10 feeder circuits.

Oil filtering system.

Feed water heater and boiler feedwater pumps.

A. C. GENERATORS

3—6½ KVA. single phase, 1800 rpm., 120/240 v. Master electric engine type with panel board (new).

25 KVA, 360 cycles, 1200 rpm, 250 v. General Electric.

35 KVA. 1200 rpm, 2300/4160 v. Electric Machinery 2-bearing type with direct connected exciter.

112½ KVA 900 rpm, 600 v. General Electric 2-bearing type separate exciter.

250 KVA 240 rpm, 480 v. Fairbanks-Morse engine type.

300 KVA 150 rpm, 4000/2300 v. General Electric engine type.

TURBINE-GENERATORS

625 KVA 2300 v. 3 phase, 60 cycle, General Electric Type ATB, 3600 rpm, 125 lbs. condensing turbine with surface condenser and accessories.

300 KW 3/60/480 v. Kerr turbine with Allis-Chalmers generator 3600 rpm, 185 lbs. ga. 15 lbs. back pressure.

CENTRIFUGAL PUMPS

500/750 gpm 125/290 ft. head 4½x4 2-stage Worthington 1150 or 1750 rpm.

500 gpm 50 ft. head 4x3 Fairbanks-Morse 1800 rpm.

350 gpm 110 ft. head 5x3 Worthington 1800 rpm.

225 gpm 90 ft. head 2½x2½ Allis-Chalmers with 7½ hp 3/60/220 3600 rpm motor close coupled.

150 gpm 100 ft. head 2½x2½ Allis Chalmers 3600 rpm.

150 gpm 42 ft. head 2½x1¾ Dayton-Dowd 1800 rpm.

D. C. GENERATORS

K.W.	R.P.M.	Volt	Make
100	257	250	West. engine type
75	270	125	G. E.
	with 14x12 Harrisburg steam engine		
50	280	125	G. E.
	with 13x11 Harrisburg steam engine		
25	305	125	G. E.
	with 9x9 Harrisburg steam engine		
67	625	125	A. C.
26	575	220	American Engine
25	1800	125	Triumph
19	1800	125	Fairbanks-Morse sem enclosed
9½	975	125	A. C.
7½	1200	125	West. 1 brg. type

STEAM ENGINE GENERATOR

208 KW 3/60/440 v. Skinner Unaflow Engine with G.E. generator. 200 rpm 185 lbs. ga. 15 lbs. back pressure.

MOTOR-GENERATOR SETS

75 K.W. 125 v. D.C. G.E. Generator with 100 hp 1200 rpm 3/6/220 v. motor.

62½ KVA 2300 v. 3 ph 60 cy Generator with 75 hp 600 v. D.C. motor 900 rpm Westinghouse.

12 KW 125 v. D.C. 20 hp 3 ph 60 cy 220 v. squirrel cage motor 1800 rpm General Electric.

10 K.W. 70 v. D.C. Rotary Converter 3 ph 60 cy 220 v. 1800 rpm Martin

MISCELLANEOUS

RIPSAW—Crescent Mfg. Co. 48"x36" table adjustable to 45° tilt. 12" saw.

SHAPER—Crescent Mfg. Co. single spindle wood shaper. 36"x36" table.

2—PIPE THREADING MACHINES—Curtis and Curtis Co. 2" to 8" and 2" to 6"—with countershafts and pulleys.

3—VARIABLE SPEED TRANSMISSIONS—Reeves Size 2 (Horizontal open type)

GAS ENGINE—Fairbanks-Morse 1 cyl. 2 hp 750 rpm.
GAS ENGINE—McCormick-Deering 1 cyl. 1½ hp 500 rpm.

WINCH—Clyde Iron Works. Single drum. 8" dia. x 12". 14 to 1 reduction. Chain drive to motor. 10 hp.

CENTRIFUGAL COMPRESSOR—General Electric 350 cfm 1.5 lbs. pressure with 3/60/220 motor built integral 3600 rpm 4 hp.

AIR COMPRESSOR—Westinghouse Air Brake, Size 10½. Steam driven. Cross compound 150 cu. ft. at 131 strokes 110 lbs. pressure at 120 lbs. steam pressure.

AIR COMPRESSOR—Westinghouse Air Brake—8" Steam driven. Single stage. 35 cu. ft. at 120 strokes.

AIR COMPRESSOR—Curtis 4½ x 4½ single stage.
STEAM SEPARATORS—12" and 5" cast iron.

CRANE-TILT—3-valve Lifting Traps—1" and 1¼".

3—STEAM GAGES—12" Dial 0-200 lbs. (new)

CONDENSER TUBES—1650 Admiralty Metal 13' long ¾" O.D. 18 gauge.

SPEED REDUCERS—25 hp 680 rpm 12:1. 16 hp 1700 rpm 18:1. 10 hp 1750 rpm 18.5:1. 5 hp 680 rpm 70:1.

MAGNETIC BRAKE—Westinghouse Type DW 230 v. D.C. 1000' lb. Torque.

ROCKWOOD MOTOR BASES—Sizes 8 and 10.

TAMPA ARMATURE WORKS, INC.

401 SOUTH MORGAN ST., **Phone M-8265** **TAMPA, FLORIDA**

We also operate **TURNER ELECTRIC WORKS, Jacksonville, Florida**

Write—Wire—Phone us if you don't see the item you need. This listing is only a part of our large stock.

M-G SETS

300 KW. Gen. Elec. type MPC gen. DC 170 volts 1760 amp. coupled to 450 HP G.E. motor DC 250 V. 1150 RPM (can furnish A.C. drive).
100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage 1-K motor 3-60-2200/4000 V.—1200 RPM.
50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80 HP C-W motor sq. cage 3-60-220/440.
40 KW Martin rotary converter, input 3/60/220 v., output DC 230 v., with panel.
37½ KVA Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. SK motor DC 230 V. 1150 RPM, 3 brg.
35 KW Gen. Elec. DLC gen. DC 250 V. to 50 HP AC motor 3-60-220/440 V.
30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v.

Others available—special units built to order.

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P	Mfr.	Type	Speed
1	400	Gen. Elec.	I-K	1800
1	200	G.E. 2200 v. 3brg.	I-K	600
1	200	F.M. l.b. 2200 v.	H	1800
3	165	Gen. Elec.	I-K	1800
1	150	Gen. Elec.	IK-15A	900
1	100	Allis Ch.	AN	600
1	60	Gen. Elec.	I-K	3600
1	50	Gen. Elec.	I-K	1200
1	50	Gen. Elec. vertical	KT	1200
1	40	Allis Ch.	AN	1200
1	40	Gen. Elec.	I-K	900
2	40	G.E. vertical	KT532	1200
1	40	Ideal	AA	900
1	30	Lincoln	C	900
1	30	Gen. Elec.	I-K	720
1	30	Allis Ch.	AN	900
1	25	Gen. Elec.	I-K	600
1	25	Whse.	CS	900
2	20	Gen. Elec.	KT532	600

D. C. MOTORS

H.P.	Mfg.	Type	Volts	Speed
450	Gen. Elec.	MPC	230	1150
125	Whse.	SK	230	850
125	Cr. Wheeler	125H	230	500
100	Cr. Wheeler	101H	230	550
75	Cr. Wheeler	125H	230	350/750
75	Whse.	S13	125	475
75	Gen. Elec.	DLC	230	400
65	Cr. Wheeler	65H	230	600
65	G.E. Northern	C	230	375/750
60	Diehl dynamo	R10	250	500/2000
50	Whse.	SK	230	1150
50	G.E. Sprague	LC	250	700
50	Whse.	SA	230	450/1350
50	Cr. Wheeler (5)	50H	230	700
40	Gen. Elec.	DLC	230	750
40	Roth	S	115	850
40	Whse.	SK	230	1700
35	Fair. Morse	TRC	230	1150
30	Sprague	dynamom	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
25	Whse.	SK	230	950
25	Sprague dyna.	IC	115	700/1500
25	Gen. Elec.	FC32	230	800
25	Star b.b.	SB15	230	1750
20	Imperial int. dty.	D37	230	1200
20	Gen. Elec.	LC	230	575
20	Gen. Elec.	DLC	230	230/1500

25 CYCLE MOTORS

H.P.	Mfg.	Type	Speed
450	Whse. 2200 v.	CW sl. rg.	750
150	Whse.	HD sl. rg.	500
100	Whse.	CCL sq. cg.	500
50	Allis Ch.	ANY sl. rg.	1500
75	Gen. Elec.	I sq. cg.	750
30	Gen. Elec.	IM sl. rg.	750

SYNCHRONOUS MOTORS

H.P.	Mfg.	Type	Volts	Speed
750	Allis Ch.		220/400	1200
300	Whse.	ped.	220/440	900
250	Gen. Elec.	ATI	220/440	514
200	Elec. Machy.		220/440	600
50	Gen. Elec.	TS	220/440	900

CENTRIFUGAL PUMPS
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.
8" Worthington, 2000 gpm @ 200 ft.

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfg.	Type	Speed
1	400	Gen. Elec. 3 brg.	I-P	450
1	300	Burke	EMV	225
1	250	Cr. Wheeler	SR	600
1	200	Burke	EMV	514
1	150	G.E. 2200 v. vert.	I-M	1200
1	100	Burke	EMV	600
1	60	Whse. 2200 v.	CW657	1800
1	60	Gen. Elec.	I-M	720
1	50	Gen. Elec.	I-M	600
1	40	Gen. Elec.	MT532	1200
1	40	Fair. Morse b.b.	HV	900
2	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	40	G.E. 550 v	MT536	900
1	37	G.E. int. duty	ITC	600
1	35	Fair. Morse b.b.	HV	1800
3	35	Lancashire b.b.	late	1800
2	30	Allis Ch.	HNY	900
1	25	Gen. Elec.	I-M	1200
1	25	Wagner	19TBR	1200
1	25	Whse.	CW	720
1	50	Whse.	MW332	900
1	20	Wagner	19TRS	900

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec. 1 brg.	MPC	125/170	1150
100	Fair. Morse	TR	250	800
75	Whse.	S	125	600
60	Gen. Elec.	DLC	250	450
50	Cr. Wheeler	CC	125	1800
50	Cr. Wheeler	CCD	250	850
35	Gen. Elec.	DLC	250	900
30	Lincoln b.b. 600 amp.		50	1200
25	Whse.	S	125	1200
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	RC	250	900
25	Whse. (3) b.b.	SK113	250	1800
20	Allis Ch. (2)		125	475
16	Cr. Wheeler	CCD	125	415

ALSO IN STOCK . . . OIL SWITCHES BLOWERS & FANS - SPEED REDUCERS

60 CYCLE A.C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
300	Whse.	ped.	240/480	900
300	Elec. Machy. 3 brg.		240/480	720
200	Gen. Elec.	ATB	2300	600
165	Elec. Machy.	BRKT	240/480	900
150	Allis Ch. 25 cycle		240/480	500
100	Cr. Wheeler		240/480	600
75	Whse.	G	2300	900
75	Gen. Elec.	ATB	240/480	1200
31	Whse. (4)	b.b.	120/208	1200
10	Whse. (5) NEW	b.b.	240	1200

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3000 KW. 2300 V. Cond.
1—2500 KW. 2300 V. Cond.
1—1250 KW. 2300 V. Cond.
1— 250 KW. 240 V. N. C.
1—2000 KW. 600 V. Cond.
2—1000 KW. 2300 V. Cond.
2— 600 KW. 4000 V. Cond.
1— 500 KW. 440 V. N. C.
1— 500 KW. 125 V. D. C.
1— 375 KW. 440 V. Cond.
1— 120 KW. 440 V. N. C.

ENGINE GENERATORS

1—540 KW. Uniflow 480 V.
1—150 KW. 480 V.
1—600 H.P. Uniflow Eng.
1—168 KW. 550 V.
2—280 KW. 440 V.
1—600 KW. 2300 V.

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

BOILERS

1—1390 H.P. 400# Coal
1— 990 H.P. 200# Coal
1— 620 H.P. 200# Coal
3— 500 H.P. 160# Coal
1— 360 H.P. 190# Coal
2— 310 H.P. 250# Coal
2— 100 H.P. 100# Oil
2— 175 H.P. 200# Oil
1— 200 H.P. HRT 160#
5— 150 H.P. HRT 125#

MOTORS

1—200 H.P. Syn. 220 V.

AIR COMPRESSORS

2—3400 CFM 100# Motor
1—3000 CFM 100# Motor
1—1972 CFM 100# Motor
1—1573 CFM 100# Motor
2—1228 CFM 100# Motor
1— 511 CFM 100# Belted
1— 490 CFM 100# Belted
1— 600 CFM 350# Steam
1—5000 CFH 600# Belted
1—1000 CFH 3000# Belted

STOKERS

2—Combustion Type E, New
1—CE. Combustion Spreader Type

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

500 KW G.E. 250 V. 2300/4000 A.C. 900 RPM
300 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM
150 KW G.E. SYN. 250 V. 2300/4000 A.C. 900 RPM
150 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK CO.

Incorporated

502 Grant Building, Pittsburgh, Pa.

DIESEL GENERATOR UNIT

1500 H.P.—1250 KVA
Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
Immediate Stock Delivery Rebuilt

A. G. SCHOONMAKER COMPANY
50 Church St., New York 7, N. Y.
Phone Worth 2-0455

TURBO GENERATORS

750 KW., 3 ph., 60 cy., 480V. 3600 Allis Chalmers to a Moore extraction type Turbine with board.

500 KW., 3 ph., 60 cy., 480V. Westgh. non cond. Turbo Generator with board.

937 KVA., 3 ph., 60 cy., 2300V. Gen. Elec. cond. Turbo Generator.

ROTARY CONVERTER

1—1500 KW., 250 V. Westgh. complete.

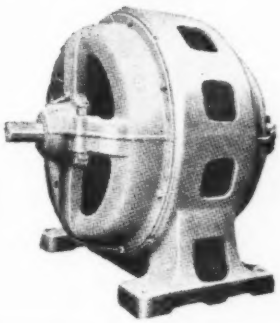
1—156 KVA., 3 ph., 60 cy., 240 volt Gen. Elec. to an 8 cylinder Buffalo engine only 5 years old, little used.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries.

What have you for sale?

KEYSTONE
Power Plant Equipment Company
8493 Hegermen St., Phila. 36, Penna.

LOOKING for BIG MOTORS?



Here's the place to find them!

Partial Stock List of 100 H. P. and over . . .

SQUIRREL CAGE—2200 VOLT

	H.P.	Speed	Description
(2)	125	1800	New Splash Proof
	150	1800	Open
	200	3600	New Open
	200	1200	New Explosion Proof
	200	900	T.E.F.C.
	200	720	Open
	200	575	Open
	250	3600	Explosion Proof
(4)	250	1200	T.E.F.C.
(4)	300	580	Open
(4)	450	3600	New Open

220/440 VOLT

	100	1800	T.E.F.C.
(2)	100	1200	New KG Explosion Proof
(2)	100	900	Open
	115	1200	Open
	125	1200	Open
(2)	125	900	Open
	200	3600	Open
(6)	200	1800	New Open
	200	900	Open
	225	1200	New Open
	250	1200	Open
	300	3600	New Open
	300	300	2 Bearing Open

SQUIRREL CAGE—550 VOLT

(2)	150	1800	Open
	175	1200	Open
	200	1200	Open
	200	720	Open
	250	900	Open

DC GENERATORS—125 VOLT

100	1200	Crocker Wheeler
100	1000	General Electric
100	250	Westinghouse

SLIP RING—2200 VOLT

	H.P.	Speed	Description
	100	900	Open
	150	1200	2 Phase Open
	200	600	440 Volt Open
(2)	200	1800	Open
	200	600	Open
	250	600	Open
	300	1800	Open
	400	600	2 Bearing Open
	500	700	Hoist Duty Open

SLIP RING—550 VOLT

	100	570	Open
	112	490	Open
(2)	150	600	Open
	300	600	Open
	300	514	2 Bearing Open

VERTICAL

	100	900	440 Volt Explosion Proof
	150	1800	220 Volt Hollow Shaft
(2)	150	1200	220 Volt D.P. Hollow Shaft
(4)	200	900	440 Volt Explosion Proof

DC MOTORS—230 VOLT

100	1800	Westinghouse
100	1200	Westinghouse
100	1100	Westinghouse
100	300/600	Westinghouse
104	925	General Electric
182	200/400	General Electric
250	400/1200	General Electric
250	450	General Electric
300	800	General Electric
300	500	Electric Dynamic

Our stock of motors from 1 to 100 H.P. runs into the thousands. You can be sure of getting the Motors, Generators, Transformers, etc. you need by wiring collect to

ELECTRIC EQUIPMENT CO.
TELEPHONES: GLENWOOD 6783-6784-6785
63 CURLEW STREET, P. O. BOX 51 ROCHESTER 1, N. Y.

BOILERS

10 to 1000 H.P.
NEW - USED
RECONDITIONED
Steam, Gas and Electric
Power Equipment
J. PARKER THOMPSON CO.
501 FIFTH AVE., NEW YORK CITY
MURRAY HILL 2-5740

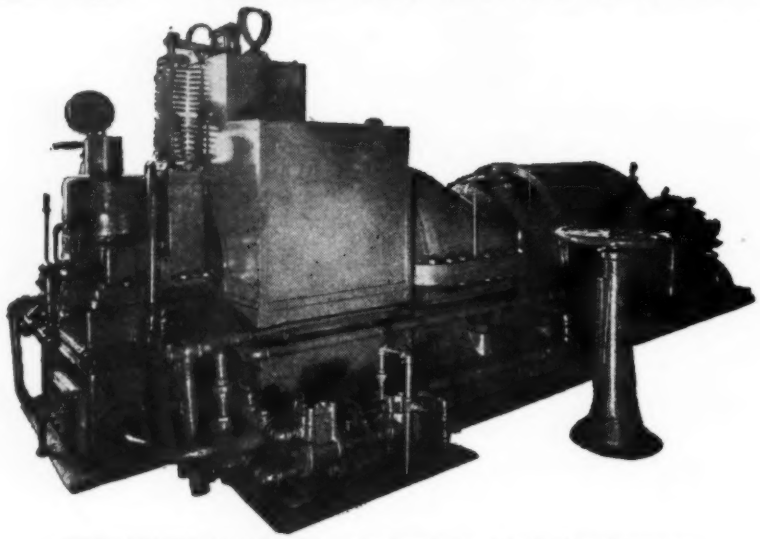
COMPRESSORS
Vacuum Pumps

New & Guaranteed Rebuilts
Stationary & Portable
SALE OR RENT
Worthington Authorized Distributors
AMERICAN AIR COMPRESSOR CORP.
4704 Dell Ave., — N. Bergen, N. J.
N. Y. Phone Ch 4-7665. N. J. Phone Union 5-4848

DIESEL UNITS
625 HP Cooper Bessemer 240 V.—D.C.
300 KVA Fairbanks Morse 2400 V.
2—100 KW Chicago Pneu 250 V. D.C.
250 KW Busch Sulzer 240 V.
250 H.P. Busch Sulzer 257 rpm. Engine.
192 KW McIntosh Seymour 2300 V.
100 KW Busch Sulzer 2300 V.
2—11,500 & 20,000 Gal. Steel Tanks.
80 H.P. F.M. 300 rpm. Diesel Engine.
R. C. STANHOPE, Inc., 60 E. 42nd St., N.Y. 17, N.Y.

APPLICATION ENGINEERS
3000 KW 200 lb. GE Cond. Turbine Set.
2—140,000 lb. Cap. 650 lb. WP Boilers.
200 KVA 480 Volt AC Ridgway 4-Valve Eng. Set.
360 HP 240 Volt AC Fairbanks Morse Diesel Set.
180 HP 2300 Volt AC Fairbanks Morse Diesel Set.
100 HP Fairbanks Morse Diesel Engine with Clutch.
50 KW M.G. Set 440 AC to 250 DC.
HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd. Chicago 4, Ill.

TURBO-GENERATORS



WESTINGHOUSE, 1000-KW. Aut. Extraction-Condensing Turbine-Generator

A Partial List of our Stock is noted Below

20000—KVA-West Surf.Cond. 250/400# 2300-V
7500—KVA-G.E. Surf.Cond. 190/375# 2300-V
6250—KVA-G.E. Surf.Cond. 200# 2300-V
6250—KVA-A-C. Non.Cond. 425# 185#BP
3750—KVA-G.E. Surf.Cond. 200# 2300-V
2500—KVA-G.E. Surf.Cond. 200# 2300-V
1875—KVA-G.E. Cond'sing. 200# 2300-V
1565—KVA-G.E. Surf.Cond. 150# 2300-V
1250—KVA-West. 200# 2300-V
1250—KVA-A-C Non-Cond. 150# 480-V
1250—KVA-West. Surf.Cond. 200# 2300-V
937—KVA-A-C Condens'g 2300-V

Also Specialists in Diesel Engines, Boilers & Genl. Power Plant Eqpt.

WE OWN and CAN SHIP FROM STOCK

400-HP. Cooper Bessemer Diesel Engines
400-HP. 320-HP. 120-HP. Atlas Imperial Diesel Engines

Also Any Other Size or Capacity Diesel Engine Desired

WRITE OR WIRE US

CHARLES WEAVER & COMPANY, DETROIT, MICH.

4045 Penobscot Building—Telephone Cadillac 1340-1

POWER PLANT SPECIALISTS

SPECIAL OFFERING

3—1000 H.P. 375# Pressure Unused Water Tube Type Boilers, with all Trim including Super Heaters, Oil Burners, Economizers, and Boiler Controls. Also Boilers 150-1500 H.P. (at various pressures).

NOTE TO READER

The rapid turnover of our stock has made us feel we cannot publish a complete list of current offerings.

State your needs—We will post you promptly.

Our present stock consists of over 5000 items, in our warehouse consisting of all types of TURBO GENERATORS, SWITCHGEAR, AIR and OIL CIRCUIT BREAKERS, RELAYS of all types, TRANSFORMERS, PUMPS, 800 VALVES—NEW and USED, up to 1500# pressure, and other items used in Industrial and Power Plant Construction.

HOWE BROTHERS

324-328 PEARL ST., NEW YORK 7, N. Y.

Phone—Worth 2-2708—2709—2710

PIPE

CUT TO SKETCH ⅛"-24"

METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
LARGE SURPLUS STOCK
STEEL-WROUGHT IRON-CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Sarco Valves
313 East 31st Street, N.Y.C.
HOURLY NATION WIDE SHIPMENTS
Phone MUrray Hill 3-3408

FLANGED VALVE & FITTINGS

87.5 KW G.E. M/G Set 250 Volts DC driven by synchronous motor .85 P.F. 1200 rpm complete with controls

Designers and Manufacturers of Special Electrical Equipment

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th Street, Phila. 22, Pa.

FOR SALE

Diesel engine generating units 50 H.P. and up; gas engines with or without generators, 50 H.P. and up; steam engine generating units 62 KW to 400 KW; generators and turbines.

Write me your needs.

A. C. ASKEW,
Box 3073, Whittier Station, Tulsa 8, Oklahoma.
Phone 6-6120

...some of these are being checked for definite specifications right now.

For instance, a few of the non-condensing turbo units look good, there are a couple of pretty fair extraction machines, and some of the straight condensing sets will stand inspection.

Non-condensing turbo generators: 500 to 1750 KW built 1920 to 1930 140# to 250# ISP

Extraction turbo generators: 1000 to 2500 KW all built around 1920-21; all 200# ISP, up to 30# ga. extraction

Straight condensing turbo generators: 300 to 12,500 KW built 1921 to 1935; from 140# to 250#

On several others, we have only tentative data and release -

Four 2000 KW, a 4000, one 7500, a couple of 5000's built 1930 to 1943 and 250 to 450# ISP, condensing

These frequency changers are all good -

and 25/60 true cycles
—one 500 KW, a couple of 1500's, a couple of 2000's, and three 2500's

These boilers have been checked for internal conditions

Four 300 HP 200# built 1925, four 460 HP 225# built 1926, two 600 HP 200# built 1920, one 1000 HP 200# built 1918—rebuilt 1940, four 1000 HP 250#—built 1925 (two retubed 1945), one 1200 HP 375# built 1928 and a few good return-tubular boilers, locomotive type, firebox boilers, and package steam generators from 80 to 200 HP are available

Incidentally, we have a few power and distribution transformers but not half enough - will you drop us a line on your surplus?

PAUL STEWART & CO., INC.

UNION TRUST BUILDING **CINCINNATI 2, OHIO**

Over 50 Years of Service

BOILERS-TURBINES

2—400 H.P. Erie City, type-E. stokers, OHIO, PENN'A & ASME stamping.
2—400 H.P. Springfield, oil burners, N. J. & ASME stamping.
2—25,000# per hour, 425#, 650 T.T. boiler & turbine complete plant (1) 1500 K.W. bleeder, (1) 1500 K.W. back pressure turbo's, National Board boilers.

H. P. BREARLEY
3423-91st Street
Jackson Heights, N. Y.

-TRANSFORMERS-

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 135-F

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M **Since 1912** **CINCINNATI, OHIO**

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

Electrical Equipment

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers.

C. B. LOCKE CO.
P. O. BOX 3227
TEL. 38-136
CHARLESTON, W. VA.

NEW and REBUILT

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR—GENERATOR SETS

KW	Make	DC Volts	AC Volts
600	G.E.	600 Syn.	3/60/2300/4000
500	G.E.	250 Syn.	3/60/6600
400	G.E.	275 Syn.	3/60/440
300	G.E.	250 Syn.	3/60/480
275	Al. Ch.	440 Syn.	3/60/1200
225	Ideal	115 Syn.	3/60/2200
200	Elliott	115 Syn.	3/60/480
100	G.E.	250 Syn.	3/60/2200
75	Wtg.	110 Syn.	3/60/2300
50	Cr. Wh.	3/60/240 DC	230
20	L. Allis	230	3/60/220
15	Heatner	220	3/60/220
14	G.E.	125	3/60/220
12½	Sprague	125	Balancer
8	Al. Ch.	120	3/60/440
8	Heatner	220	3/60/220
7½	G.E.	60 Ind.	3/60/440
7	Heatner	220	3/60/220
6	Cr. Wh.	125	Balancer
5	Ideal	250 DC	230
5	N.W.	3/60/110/220	DC 230
3	Wtg.	220	3/60/440
3	Lincoln	110 Ind.	3/60/220
2	Elec. Spec.	750	3/60/440
5	R. Myers	115 DC	115
2	G.E.	6	3/60/115
.38	W. Elec.	110	1/60/110

GAS ENGINE SETS

Qu.	KW	Make	Volts
2	5	Globe	110 DC
1	5		115 DC
2	5	J. Wind	32 DC
2	3	Waukesha	115 DC
1	2.5	B. Stratton	110 DC
1	2	Wisconsin	115 DC
3	1.5	Kohler	115 DC
1	.6	Homelite	110 DC
15	.5	Climax	110 DC
2	.5	Delco	120 DC
5	.5	B. Stratton	150 DC
12	.5	Jacobson	32 DC
50	.4	Champion	12 DC
10	.3	Pioneer	110 DC
1	.25	Pioneer	110 DC
3	.25	Leach	115 DC
40	.25	B. Stratton	115 DC
1	.25	B. Stratton	110 DC

FREQUENCY CHANGERS

1—10 HP Louis Allis type OH, 3/60/220/440 syn. motor, direct connected to 33 amp 3/180/220, speed 18 RPM.
1—25 HP Allis Chalmers type AN 3/60/220 direct connected to 25 KW 3/240/220 speed 1750 RPM.
1—25 HP GE type 3645, 3/60/220/440 direct connected to 25 KW GE, frame 4052.

TURBINE GENERATOR SETS

3000 KE, General Electric, 200 lbs. Curtis turbine 4-stage, 3 phase, 60 cycles, 2300/4000 volts, 80% P.F. 1800 RPM, all complete, condensing, can be arranged for bleeding;
1500 KW, Westinghouse, 1800 RPM, 150 lbs. 3/60/2300 volts, non-condensing, 5# back pressure.
500 KW, Westinghouse, 3/60/2300 volts, non-condensing 150 lbs. 5 to 15 lbs. back pressure.

SLIPRING MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
600	Wtg.	CW	2300	343
500	Al. Ch.		440	600
350	Wtg.	CW	2300	720
200	G.E.	IM	2200	600
200	Ideal	AV	220	585
100	Al. Ch.		440	900
100	Wtg. vert.	CW	2200	1160
75	Wtg.	CW	440	720
60	G.E.	IM	440	862
50	Al. Ch.	ANY	440	690
50	Wtg.	HF	220	860
50	G.E.	MT	440	1800
50	G.E.		440	860
40	Cr. Wh.	20Q	220	1160
40	G.E.	MT	440	860
35	Wtg.	CW	440	1200
35	F.M.	UAV	220	1800
35	G.E.	IM	220	900
35	G.E.	IM	220	1200
30	G.E.	MT	220	570
30	Ideal	AV	220/440	1160
30	Wtg.	HF	440	860
25	G.E.	IM	220	855
25	G.E.	IL	220	600

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
350	G.E.	KT563	440	1765
200	Lincoln		440	600
200	Al. Ch.		440	580
200	Wtg.	CCL	440	1200
150	G.E.		2200	700
150	Howell		440	1800
150	Wtg.	CS	2200	1716
150	Wtg.	CS	2200	720
100	Al. Ch.	AR	2300	900
100	Al. Ch.	AR	2300	600
100	Wtg.	CS	2200	870
75	G.E.		440	1725
60	Wtg. vert.	CS	2200	1750
50	Al. Ch.	ARV	220/440	1750
50	G.E.	IK	220	485
50	Howell		440	514
40	G.E.	K505Y	220	585
40	Cr. Wh.		220	1800
40	Cr. Wh.		220	1800
40	Al. Ch.		440	850
35	Al. Ch.		440	480
35	G.E.	KT	220	900
35	Al. Ch.		440	680
35	G.E.	IL	220	900
35	G.E.	IK	440	680
30	G.E.	KT	220	685
25	G.E.	KT	220	1200
25	G.E.		220	900
25	Wtg.	CS	440	900
25	G.E.	KT	220	720
25	Howell	SC	220	600
25	G.E.	KT	220	1150
20	U.S.	SL	220/440	3600
20	G.E.	KT	220	3450
20	Wl. Weichsel	15VRN	440	1200
15	L. Allis	OS-326Y	220/440	1740
15	G.E.	IK	220/440	1200
15	G.E.	FT	220	570
15	Burke	EM	220	600
15	Wagner	15RPI	440	1160
10	Cr. Wh.	115Q	220	1130
7½	G.E.	KT	440	1200
7	G.E.	KT	440	3600
7	F.M.	HSZW	220	3600
7½	F.M. vert.	UHI	220/440	3470
5	Wagner	CP-6	220/440	720
5	Sterling	KFWFCT	440	1800/900
4–6	G.E.	KT	440	900/1200
4	Ilg.	Fr. 107	220	690
4	Hertner	AE4424	220/440	1450
3	Howell	SCB18	440	600
3	Wtg.	CS	220/440	1150

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
500	G.E.	TS	2300	450
400	W.T.G.		4160	1200
2–300	El. Machy.		440	900
270	G.E.	AQI	2300	600
200	Burke	AC-62	2300	600
190	G.E.	Box type	480	600
150	Burke	SI	2200	600
100	G.E.	TS	440	450
60	G.E.	K504	440	1200
50	G.E.	K405	220/440	1800
40	G.E.	K404	220/440	1800
15	Century	open	220/440	1200
7½	G.E.	K284	220/440	1800
5	G.E.	K326	208	1500
1½	G.E.	K224	220/440	1200
1	G.E.	K204	220/440	1200

A. C. GENERATORS

KVA	Make	Type	Volts	Speed
250	G.E.	ATB	480	600
225	G.E.		240	600
225	G.E.	ATI	440	600
200	G.E.	ATB	240	600
175	Wtg.	Ped.brg.	2200	900
100	Al. Ch.		440	900
75	Al. Ch.	SB	240	1200
60	Triumph	A13LL	220	1200
50	Cr. Wh.	ALT	240	1800
9.4	Century	Open	120	1200

STEAM ENGINES

375 KVA McIntosh Seymour Cross Compound engine, with Westinghouse Elec. 3 phase 60 cycle 2300 volt generator.
400 KVA Filer-Stowell 15x28x36 cross compound Corliss engine, with Crocker-Wheeler 3 phase 60 cycle, 220 or 440 volts AC generator.
500 HP 16x32x36 Vilter Corliss tandem compound condensing engine with a double eccentric. Connected to Allis-Chalmers 3 phase 60 cycle 220 volt generator.

This is a partial listing, only have NEW from ¼ to 75 hp right in stock.

WE ARE ALWAYS IN THE MARKET FOR ALL TYPES OF GOOD MODERN ELECTRIC MOTORS, MOTOR-GENERATOR SETS GENERATORS, TRANSFORMERS, AND OTHER ELECTRICAL EQUIPMENT. SEND US YOUR LISTS FOR BEST CASH OFFERS.

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 CHICAGO 8, ILL.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 phase 25 cycle, 220/440 Volts

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
10	Wagner	19TBM		750
10	Wagner	19TBM		750
10	Wagner	19TBM		750
15	G.E.	I Form K		750
15	West.	CS	4052	750
15	West.	CS	573	750
15	West.	CS	573	750
15	West.	CS	573	750
15	G.E.	KT	303	1500
20	West.	CS		730
20	West.	CS	645	715
20	West.	CS	645	715
20	West.	CS	405	675
20	West.	CS	405	675
25	West.	CS		730
25	West.	CS		715
40	G.E.	I Form K		750
40	G.E. (S. R.)	MT	347	750
40	G.E. (S. R.)	MT	347	750
50	G.E. (S. R.)	MTC	5537	750
75	G.E. (b.b.)	KT	557	750
75	G.E.	KT	559	500
75	G.E.	I Form K		500
75	G.E.	I Form K		500
75	G.E.	I Form K		500
75	G.E. (2200 v.)	I Form K		750
100	G.E.	I Form K		750
100	West.	CS		750
100	West. (2200 v.)	CS	871C	730
100	West. (2200 v.)	CS	871.52C	1460
100	West. (2200 v.)	CS	871.52C	1460
125	West. (S. R.)	CW		480
150	G.E.	I Form K		365
150	Crocker Wh.	75R		725
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S. R.)	I Form M		480
200	G.E. (S. R.)	I Form M		480
200	West. (S. R.)	CW	1011	480
200/400	G.E. 2 Sp.	K	569BB	760/1485
225	Elec. Mach. (2200 v.)	Synchronous		500
300	West. (S. R.)	CW		500
500	G.E. (2200 v.)	KT		487
500	G.E. (550 v.)	I Form K		500

MOTORS

25 Cycle—3 Phase—550 Volt

				RPM
7 — 25 HP	West.	Type CS		3/25/550/750
1 — 30 HP	West.	Type CS		3/25/550/750
1 — 60 HP	West.	Type CS		3/25/550/750
1 — 65 HP	West.	Type CS		3/25/550/500
1 — 100 HP	West.	Type CS		3/25/550/750

TRANSFORMERS

3—150 KVA West., OISC—25/1/2300/460.
3—200 KVA West., OISC—25/1/2300/460.
3—500 KVA Pitts., OISC—25/1/2300/230/460.
1—2500 KVA Gen. Elec. 60/3/22000/2200 Y.

3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	9445931
20	Westinghouse	CS	1200	2160500
20	Westinghouse	MS	1200	1050826
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BF	1200	126906
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	Westinghouse	MS	1800	1606800
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	General Electric	14	1800	181444
50	General Electric	KT-352	720	
50	Allis Chalmers		1800	3K28825
60	Reliance		1200	B11458
60	General Electric	J	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438385
150	Westinghouse	CS	1200	4572596 (2200 v.)
150	General Electric	I-K	1200	
150	Westinghouse	CCL	720	808349 (2200 v.)
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	I-K	600	2246834
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845

SLIP RING MOTORS

3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
20	Westinghouse	CW644C	675	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	4558408
40	Westinghouse	CW748	690	4406823
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

MAGNETIC CONTACTOR

1—300 H.P. Cutler Hammer, Across the Line Contactor. 3 Phase, 25 Cycle, 440 Volts.

25 CYCLE GEARHEAD MOTORS

3—10 HP. Westinghouse Frame. 364. Enclosed 1500/378 RPM.
15 HP. Master Frame 405 Enclosed 1400/416 RPM.

SPECIAL DC MOTORS

1—40 H.P. Reliance Ball Bearing Drip Proof Type T-385-T 230 V D.C. 400/1500 RPM.
1—125 H.P. Gen. Elect. 230 V. D.C. Motor. 1750 RPM.
1—40 HP Reliance Variable Speed 230 v. DC. Drip-proof Ball Bearing 400/1500 RPM.
1—45 HP. G.E.

MOTOR GENERATOR SET

200 KW Westinghouse Synchronous. Generator Type SK 201, 250 V. D.C. 800 Amps. 900 RPM Motor. 290 HP. Synchronous. 3 Phase 60 Cycle 900 RPM. Can be wound for 440 V. or 2200 V. Complete with panels, exciter, and starting equipment.

CAPACITORS

3—30 KVA Gen. Elect. Pyranol Filled Capacitors 3/60/2300 v.
3—60 KVA Gen. Elect. Pyranol Filled Capacitors 3/60/2300 v.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. CL. 4758 BUFFALO, N. Y.

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
400	Westg.	2200	435	CW
350	Westg.	2200	900	CW
200	G.E.	220/440	1200	M-1
150	G.E.	220/440	1200	M-1
50/60	Westg.	220	1800	CW
50	Chandeysson	220/440	1800	
40-40	Westg.	220/440	1200	CW
20	Westg.	220	575	CW
15	Triumph	220	1150	
2.25	Northwestern	440	1080	HEW1½
½	Howell	220	1800	

ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
100	G.E.	220	1745	I
50/32	G.E.	440	800/640	
50	Chandeys'n	220/440	1800	
50	Westg.	440	1200	CS
40	Westg.	440	870	CS
30	Westg.	220/440	680	CS
25	Westg.	440	1200	CS
20	Westg.	220/440	515	CS
20	Westg.	440	860	CS
15	Westg.	440	720	CS
15	G.E.	220	900	ITC
15	Triumph	220	1150	
15	Westg.	440	1200	CS
10	Westg.	440	900	CS
10	Westg.	440	1200	CS

VARIABLE SPEED MOTORS—230 VOLT D. C.

H.P.	Make	R.P.M.	Type
50	Westg.	250/750	SK
25	Westg.	600/1200	SK
20	Westg.	500/1500	SK
20	Westg.	750/1500	SK-110L
20	Westg.	625/1250	SA-6
15	Reliance	500/1800	
15	Westg.	875/1600	SA
10/15	Electro Dy.	600/1200	
10	Westg.	800/1600	SA
10	Cr. Wh.	690/895	CMC
10	Reliance	850/1700	
10	J.C. Curran	950/1230	
10	G.E.	625/1250	LC
10	Westg.	565/1130	S-6
10	Westg.	400/1600	SA
7½	Westg.	450/1800	SK
7½	Westg.	650/1300	
7½	Westg.	425/850	SK
7	Westg.	660/1050	S
5	West.	400/800	SK-80
4	G.E.	850/1700	LC-8
3	G.E.	400/1200	RLC-114
3	Roth	500/1000	RS

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
175	G.E.	230	475	MD
140	G.E.	230	410	MD
80	West.	230	490	76-A
50	G.E.	230	550	MD-106
50	Cr. Wh.	230	500	SM
35	Westg.	230	550	49D
35	Westg.	220	500	49-D
32	G.E.	230	450	801
32	Shaw	230	485	5L2E
28	Westg.	230	395	904
25	Westg.	230	600	MT
15	West.	220	650	
15	Cr. Wh.	220	270	SM
10	Westg.	230	750	MT-00
7½	Westg.	230	725	L
7½	Westg.	230	975	S
3½	Westg.	230	1200	L

230 VOLT DC MOTORS

H.P.	Make]	R.P.M.	Type
80	Westg.	490	76-A
25	Westg.	600	SK
25	G.E.	650	MD
25	Westg.	825	SK113
20	Westg.	600	M
20	Westg.	750	SK
20	Westg.	975	S-6
20	Western Elec.	1000	E-40-M

D.C. CLARK CONTROLLER

1—250 HP Clark Vari Time magneto controller 230 v. DC reversing, used for plugging service. Can also be used for non-reversing.

MOTOR GENERATOR SETS—250 & 500 V. D. C.

1—300 KW. 250/275 v. DC compound wound interpole Allis Chalmers Generator direct driven by 2200 v. 3 ph. 60 cy. Allis Chalmers synchronous motor complete with AC and DC switchboard panels.
1—80 KW 720 rpm. 250 v. G.E. Generator V-belt driven by 150 HP 1800 rpm. 220 or 440 v. 3/60 Westg. Motor.
1—33.3 KVA 1800 rpm. gen. dir. conn. to 40 HP 230 v. G.E. Mtr.
1—30 KW 250 v. DC generator direct driven by 46.5 HP 1750 rpm. 220/440 v. 3/60 Westg. Motor.
1—30 KW 250 DC 1150 rpm. Reliance Generator dir. driven by 50 HP 220 or 440 v. 3/60 motor.
2—20 KW 1700 rpm. 250 v. Westg. SK Gens. dir. driven by 30 HP 220 or 440 v. 3/60 cy. motors.
1—3 KW 1350 rpm. 250 v. type S Westg. Gen. dir. conn. by coupling to 5 HP 1350 rpm. 110 v. Westg. Mtr.
1—10 KW. 250 v. DC Generator direct driven by 220 or 440 v. 3 ph. 60 cy. motor.

INDUSTRIAL TRUCKS

6—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.
9—New 4 ton Yale & Towne model YSW Multi-Stroke Hand Lift Platform Trucks.

ROTARY CONVERTERS

3—150 KW. 1200 rpm. 250/275 v. DC, 3 ph. 60 cy. AC Westg. Rotary Converters.
3—300 KW. 550 v. DC 1200 rpm. 3 ph. 60 cy. AC Westg. Rotary Converters.

WRITE, WIRE OR PHONE YOUR ELECTRICAL NEEDS—SEND FOR STOCK LIST, LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

MOTORS—M. G. SETS—CONTROL

In Stock—Immediate Shipment—Rebuilt & Guaranteed

230-VDC. CRANE & MILL MOTORS

HP.	Make	Type	RPM.
(1) 2½	G.E.	C.O. 1803 (C.P.)	650
(1) 3	G.E.	C.O. 1803	700
(1) 5	G.E.	M.D. 101	800
(1) 6	G.E.	C.O. 1805	1150
(1) 7½	G.E.	C.O. 1804	725
(3) 7½	Westghse	K-4	750
(1) 7/10	G.E.	M.D. 102 (Bk.Ax.)	1025/800
(1) 9	G.E.	M.D. 102 (C.P.) (Bk.Ax.)	975
(1) 10	G.E.	C.O. 1805	925
(1) 10	G.E.	C.O. 2504	700
(4) 11	Westghse	K-5	700
(6) 14/19	C.W.	B.W. (Bk.Ax.)	675/560
(4) 14/19	C.W.	B.W.	675/560
(2) 15	G.E.	M.D. 406 (A.E.)	725
(1) 15	Westghse	K-5	700
(4) 15	Westghse	MCA-30	600
(1) 21	G.E.	Type 52	345
(1) 20	Westghse	HK-6	650
(1) 25	G.E.	COM-1828 (C.P.)	850
(2) 27½	Westghse	K-7	535
(2) 35	G.E.	CO-2506	650
(1) 30/45	C.W.	D.W.	620/520
(1) 30/45	G.E.	MD-104½ (C.P.)	625/500
(2) 37/30	Westghse	MCA-50	500/550
(1) 40/30	Westghse	MCB-50 (Bk.Ax.)	440/525
(1) 52	Westghse	K-10 (Bk.Ax.)	740
(1) 52	Westghse	K-10	740
(1) 54/80	C.W.	F.W.	575/480
(1) 60	G.E.	MD-105 (C.P.)	550
(4) 65	Westghse	MCB-60 (Bk.Ax.)	425
(1) 65	G.E.	CO-1811 (C.P.	800
(1) 65	G.E.	CO-1811	800
(1) 70/90	Westghse	MCB-70 (Bk.Ax.)	440/400
(2) 85/110	G.E.	MD-107	500/450
(1)	Westghse	MTA-42 (Bk.Ax.)	

All above series except where C.P. = Compound Wound, (Bk. Ax.) = Back Axle.

MOTOR GENERATOR SETS

1—200 K.W., 250-275 V DC. Allis Chalmers, factory built set with 283 HP. Syn. motor, 80% P.F., 440/3/60 cy. A.C. & D.C. panel, O.C.B. & starting equipment.

VARIABLE SPEED MOTORS 230-VDC.

HP.	Make	Type	RPM.
(1) 3	G.E.	RLC-111 (SH.)	500/1500
(1) 3	G.E.	CR-3	500/1500
(1) 3 (Drip-proof B.B.)	Reliance	14T (SH.)	1200/3000
(1) 5	G.E.	RLC-115 (SH.)	250/1000
(1) 5	G.E.	RF-9 (SH.)	450/1350
(1) 5	Westghse	SK-33 (SH.)	1150/1650
(1) 6	G.E.	RF-9 (SH.)	450/1350
(1) 7½	G.E.	RF-10A (SH.)	450/1350
(1) 7½	Westghse	SK-70	600/1800
(1) 7½	Westghse	SK-70	600/1000
(1) 7½	Westghse	SK-60L (C.P.)	650/1300
(1) 7½	Westghse	SK	850/1700
(1) 8	Westghse	SK-100L (SH.)	300/1200
(1) 8½	G.E.	RF-9 (SH.)	600/1800
(1) 10 (115-v.)	Elec. Dy.	7½-S	250/1000
(1) 10	Westghse	SK-80L	800/1500
(1) 10	G.E.	CD	850/1250
(1) 10/15 (new)	Allis-Ch.	EB-100 (SH.)	575/1725
(1) 10	Westghse	SK	600/1500
(1) 12	Westghse	SK	600/900
(1) 15	Westghse	SK (SH.)	400/1600
(1) 15	Westghse	SK-100L	450/1500
(1) 15	Reliance	131-T (SH.)	500/1500
(1) 19	Westghse	SK-100L (C.P.)	600/1200
(2) 20	G.E.	RLC	600/1200
(1) 20	G.E.	RLC-702	250-1000
(1) 20	Triumph	Comp.	250/1000
(1) 20	Westghse	SK	650/2200
(1) 25	G.E.	CD-128Y (SH.)	200/800
(1) 25	G.E.	RF-13 (SH.)	400/1200
(1) 25	Reliance	F-3 (C.P.)	500/1500
(1) 30	Westghse	SK-163 (SH.)	400/1200
(1) 35	Westghse	SK-160 (C.P.)	500/750
(1) 45	Reliance	310-T (SH.)	500/1500
(1) 50/60	G.E.	RLC-205 (SH.)	400/1200

2—150 HP., Electro Dynamic Variable Speed, 3-bearing, Frame 75-S, Comp. Interpole, 250/500 RPM., 2 hrs. 185 HP., with Monitor Control Panels, built in Resistance, Auto 4-step acceleration, non reversing, P.B. control.

Constant Speed 230-VDC. Motors

H.P.	Make	Type	RPM.
(2) 2	Al.-Ch.	E-50	1750 SH
(1) 3	Reliance	T-224	3500 SH.
(1) 3	G.E.	CD-55	1150 SH.
(1) 5	Westghse	SK-33	1150 SH.
(2) 5	Westghse	SK-40	850 SH.
(1) 5	G.E.	RC-27A	1150 SH.
(1) 5 (new)	Al.-Ch.	EB-65	1750 SH.
(2) 7½	Westghse	SK-60	850 C.P.
(5) 7½	Westghse	SK-43	1150 SH.
(1) 7½	Westghse	SK-5L	550 C.P.
(1) 7½	Westghse	SK-40 (115-V.)	1150 SH.
(1) 10 (new)	Al.-Ch.	EB-80	1150 SH.
(1) 10	Westghse	SK-50L	1300 SH.
(1) 15	Al.-Ch.	Shunt	800
(1) 15	Westghse	SK-100L	850 SH.
(1) 15	C.W.	CCM	800 C.P.
(2) 20 (new)	Elec. Dy.	182N (Fnc.) (B.B.)	1500 C.P.
(1) 25	Westghse	SK-100L	1100 SH.
(1) 30	G.E.	DCL-201	1100 SH.
(1) 35	Westghse	SK-130	850 SH.
(1) 50	Westghse	SK	1700 SH.
(1) 75	Reliance	T	875/1200 C.P.

SLIP RING (CONSTANT DUTY) 220/440-V., 3-PH., 60-CY.

H.P.	Make	Type	RPM.
(1) 3	G.E.	M.Q.-1801 (2-PH)	1080
(2) 7½	G.E.	M.T.-201 (550-V.)	1200
(1) 10	G.E.	I.Q. (2-PH)	1120
(1) 38	G.E.	I-M	1200
(1) 40	Westghse	C.W. (2300-V.)	575
(1) 250	Westghse	C.W.	435
(1) 400	G.E.	M.T.-412	600
(1) 500	Allis-Chal.	A.N.	585
(1) 500	Westghse	C.W. (2200-V.)	360
(1) 600	G.E.	M.T.-412 (2200-V.)	719
(1) 750	G.E.	M.T.-414 (2200-V.)	709

Above two motors with G.E. C.R. 2016 control)

SYNCHRONOUS CONDENSER

1—750 KVA, G.E., type ATI, 600-V., 3-PH., 60-CY. 900-RPM., 8.5 K.W., dir. con. exciter and complete control panel. Will furnish rewound as 683-HP. Syn. Motor, 440-V., 3-PH. 60-cy.

T. B. MAC CABE COMPANY

4312 CLARISSA STREET PHILADELPHIA, PENNA.

SLIP RING MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Speed
900	2300	G.E.	900
600	2200	G.E.	720
500	2300	G.E.	900
300	440	Al. Chal.	900
250	2300	G.E.	600
250	440/550	G.E.	600
200	2200/440	G.E.	600
150	2200	G.E.	450
150	2200/440	G.E.	600
150	440/220	G.E.	1200
125	440/220	Whse.	1200
125	440/220	G.E.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E. MTC	900
100	440/220	Whse.	1200
100	440/220	G.E.	1200
80	440/220	G.E. (MTC)	900
75	2200	Al. Chal. (new)	900
75	440/220	G.E. (MTC)	600
75	2200/440	G.E.	1200
50	2200/440	G.E.	600
175	550	G.E.	900
40	2200	Whse.	900

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-1328A. General Electric, 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt.

SYNCHRONOUS MOTORS
3-PH., 60 Cy.

500	2200	Al. Ch.		450
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN	900
300	2200	Whse.	G	720
300	440/220	Al. Ch.		600
250	4000/2300	G.E.	TS	1200
240	2200	G.E.	ATI	600
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	Whse.	G	1800
110	440/220	G.E.	TS	1800
100	440/220/25 cy.	G.E.	TS	375

TRANSFORMERS
60 Cycle

3— 833 kva. Whse., 11000-2300 V.
1— 300 kva., Whse., 3 Ph., 13800-230 V.
3— 250 kva., Whse., 13,800-460.
3— 100 kva., G.E., type H 2400-240-480.
3— 100 kva., G.E., type H-KDD, 6900/11950V-230/

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G	IK	1200
500	440/220	G.E.	IK	900
400	2300/440	Whse.	CS	720
400	2200/440	G.E.		600
400	550	G.E.	IK	720
350	440	G.E.	IK	900
200	440/220	Whse.		1200
200	2200	G.E.		1800
200	440/220	Wagner	RP	1800
200	2200/550	Al. Ch.	AR	900
150	2200/550	Al. Ch.	AR	1800
150(3)	440/220	G.E.	KT	1200
125	2200	G.E.	KT	600
100	440	G.E.	IK	450
100	2200	G.E.	KT	1800
100	440	Whse.	CS	1200
74	2200	G.E.	KT	900
50	2200	Al. Ch.		720

MOTOR GENERATOR SETS

1—100 kw, 250 v., 900 rpm, Whse., conn. to 150 hp, 2300 v., 60 cy., sq. cage motor
1—60 kw, 250 v., 1200 rpm, G. E., conn. to 90 hp, 440/200 v., 60 cy., syn. motor
1—60 kw, 125 v., 1200 rpm, Whse., conn. to 75 hp, 440/220 v., 60 cy., syn. motor.
1—35 KW, 125 V., 1800 R.P.M., G.E., conn. to 50 HP., 440/220 V., 60 cy., squirrel cage.

A.C. GENERATORS

1—300 kva, 600 rpm, 440/220 v., G. E.
1—225 kva, 600 rpm, 440/220 v., G. E.
1—190 kva, 514 rpm, 2200/440 v., G. E.
1—150 kva, 900 rpm, 440/220 v., G. E.
1— 98 kva, 1800 rpm, 440/220 v., G. E.
1— 96 kva, 360 rpm. 480/240 V. G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

WE NEED the following DIESELS!

either new or reconditioned

For Marine Propulsion:

1—1000 to 1100 HP, or twins 500/600; 600/800 RPM; with reduction gears 1:2 or 1:2.5. Max. weight 25 tons for single unit or combined for twins.

1—2000 to 2700 BHP, or twins 1100 to 1350/1400 BHP; 110/160 RPM

1—set, twin engines, 500 HP, lowest possible RPM

4—1400 HP each, lowest possible RPM

1—approximately 450 HP

1—1800 HP; 750/800 RPM; 2 or 4 cycle; single action; reduction gears to screw speed of 250 RPM.

1—3000 BHP; low RPM.

Submit prices and deliveries.

ARNESSEN ELECTRIC COMPANY

116 BROAD STREET, NEW YORK, N. Y.

HIGH PRESSURE BOILERS

2—1409 H.P. Babcock & Wilcox, Cross Drum A.S.M.E. uilt for 600# 700 degrees F. total temperature. Never operated previously over 350#. Stokers, superheaters, economizers, and forced draft equipment. Set singly with steel casings.

UNIFLOW ENGINE UNIT

1—166 K.V.A. Allis Chalmers. 3 Phase, 60 Cycle, 480 Volts (Can reconnect for 240 Volts) 225 R.P.M. direct connected to 16" x 18" AMES Uniflow engine, 150/160 pounds pressure, condensing or non-condensing.

PUMPS (U. S. Navy design)

4—C. H. Wheeler. Normal rating—2000 G.P.M. 60' T.D.H. 1500 R..M. Each direct driven by Terry turbine 38 H.P. 200# steam pressure, absolutely new. Gun metal casing and impellors.

STEAM TURBINE—GENERATORS

1—3000 K.W. 3750 K.V.A. General Electric. 3—60—2300/4000 Y volts. 200# 175 Degrees. Surface condenser and pumps. Can be seen in operation. 3600 R.P.M.
2—600 K.W. 750 K.V.A. General Electric. 3-60-600 volts, 3600 R.P.M. 200# condensing with hand extraction, 15#.
1—250 K.W. Allis Chalmers. 3-60-2300 volts, 3600 R.P.M. 150/200# condensing. Fitted for mixed pressure with 2# low pressure.

ARCHER & BALDWIN, INC.

#75 West St. New York City 6, N. Y.

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

A.C. TURBINE UNITS

3125 KVA GE 2300 v., cond.
3125 KVA GE 300#, cond.
1560 KVA Wghse. 480 v. (bleeder)
1250 KVA GE 2300 v. (bleeder)
1250 KVA Al. Chal. 480 v., non-cond.
937 KVA Al. Chal. 2300 v., non-cond.
750 KVA GE 250#, cond.
625 KVA Wghse. 480 v. (bleeder)
625 KVA Elliott 480 v., non-cond.
250 KVA GE 220/440 v., non-cond.
125 KVA CW-Moore 240 v., non-cond.
115 KVA Wghse.-Sturtevant, non-cond.
50 KVA GE-Terry, non-cond.

ENGINE UNITS

1100 KVA GE-Hamilton Unif.
750 KVA GE-Chuse Unif.
625 KVA GE-Skinner Unif.
350 KVA GE-Ames Unif.
187 KVA (2) GE-Chuse 4 v.
150 KVA GE-Ames 4 v.
90 KVA GE-Skinner Unif.

DIESEL UNITS

312 KVA GE-Anderson
250 KVA Fairbanks Morse
225 KVA Wghse.-Worthington
156 KVA Ideal-Buckeye
150 KVA Fairbanks Morse
125 KVA GE-Worthington
118 KVA (2) GE-Winton
90 KVA Ideal-Worthington
65 KVA Fairbanks Morse
62½ KVA Wghse-International

BAILER

465 H.P. Sterling 450#; with waterwalls and Pulverizers.

KIEMLE OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D.C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D.C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO

Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

PUMPS

Rebuilt & Guaranteed

PUMPS—Large stock centrifugal—turbine—piston.

STEAM PUMPS—Duplex - Simplex. Reconditioned and guaranteed.

BOILERS—stacks—Engine Generators—condensers.

LOU COHEN
PUMP & MACHINERY COMPANY
715 Howard St. St. Louis 6, Mo.
Telephone - GArfield 4290

MODERN DIESELS

475 HP Fairbanks Morse 8 cyl. Model 38 1200 rpm. opposed piston type, direct connected 330 KW 250 Volt direct current Generator. Will sell without generator.

120 HP Atlas 6 cyl., 600 rpm. direct connected 75 KW Allis Chalmers 3 phase, 60 cycle, 240 volt generator. Complete and excellent.

Both units in St. Louis stock.

Mississippi Valley Equipment Co.
507 Locust St. St. Louis 1, Mo.

FOR SALE

NON-CONDENSING TURBINE

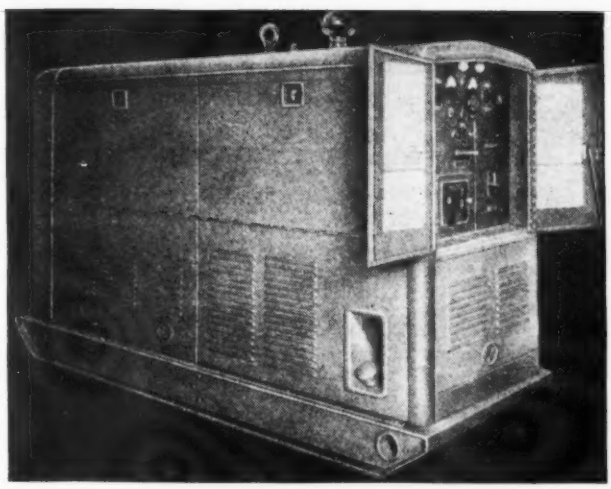
500 KW, nozzled 150#, 10" back pressure. Generator: 550 volt 3 phase 60 cycle 70% P.F.

EXTRACTION TYPE TURBINE

500 KW. General Electric, now nozzled 135# condensing, surface condenser, automatic extraction.
Generator: 550 volt 3 phase 60 cycle.

ANDREN-MYERSON CORP.
411 Atlantic Ave., Boston 10, Mass.

PORTABLE DIESEL GENERATOR SETS



15 KW 30 KW 50 KW
INTERNATIONAL UD-14—UD-18
BRAND NEW—SPOT DELIVERY
RADIATOR COOLED—SKID MOUNTED

60 cycle 127/220 volts
50 cycle 230/400 volts

SPECIAL PURCHASE BARGAIN

ROBERT SCHOONMAKER
Port Washington, Long Island, N. Y.
Phone Roslyn 1600

SEARCHLIGHT SECTION

BOILERS

12—30,000# Foster Wheeler 475# pressure boilers with oil burners, 1942.
2—600 HP Springfield Sectional Headers, 200# pressure, rebuilt.
3—768 HP Stirling Boilers, 200# pressure.
1—256 HP Stirling Boiler, 160# pressure, new tubes, stoker.

TURBINES

2—5000 KW Westinghouse 3600 RPM 3/60/2300 volts Condenser, all auxiliaries.
2—15,625 KVA General Electric Condensing Turbines.
1—3700 KVA General Electric Condensing Turbine.
1—300 KVA General Electric Condensing Turbine.

DIESEL ENGINES

3—300 KVA Fairbanks-Morse Full Diesel Engines.
3—200 KVA Fairbanks-Morse Full Diesel Engines.
1—350 KW Burch Sulzer 3-60-2300 Volt, all auxiliaries.
2—300 KVA Fairbanks Morse Full Diesel Engines.
1260 KVA Nelesco engine generator.

ENGINE GENERATOR SETS

1—750 KVA Corliss Engine Generator Set.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine.
1—150 KW Skinner Uniflow Engine Generator Set A.C.
1—600 KW Skinner Vertical A.C. Generator.
1—500 KW Non Releasing Corliss, 3-60-240 volts.

MISCELLANEOUS

90,000# Cochran deaerating feed water heater.
2500 HP Cochrane Open Feed Water Heater.
1—10' x 15' Illinois Forced Draft Chain Grate Stoker.
1—110,000# Cochrane Deaerating Heater.
2—300 HP Westinghouse Underfeed Stokers, rebuilt.
2—150 HP Canton Ram-fed Stokers.
2—75 HP Elliott Geared 900 rpm turbines 385# steam pressure.
1—232 GPM Centrifugal Boiler Feed Pump, turbine driven, 1200 ft. head.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.
325 Fincastle Building — LOUISVILLE, KY.

DIESELS

New 15 HP HILL Model 2R Diesel Power Units 2 Cylinder, 1500 RPM, includes: Radiator, Spare Parts, Battery, etc.

New 75 HP CHRYSLER Diesel Power Units, 6 Cyl., Model IND-10, 4 Batteries, Radiator, Fuel Tank, Tool Kit, Silencer.

8—used Hercules Diesel Engines, Model DFXDF, 175 HP, direct coupled to: 85 KW General Electric variable voltage DC Generators.

5—used Buda Diesel Stationary Power Units, 125 HP at 1200 RPM, Model 6 DHG691.

ALJON ELECTRIC DIESEL CO.
904-10 Pacific Street Brooklyn 16, N. Y.
Sterling 3-6515

TRANSFORMERS

3—883 Kva—2400—240/120

2—400 Kva, Pittsburgh, 25 cy, 1 ph. 6600—440/460

3—150 Kva, Westinghouse, 60 cy, 1 ph. 13200—440

6—75 Kva—2300—230/115

6—50 Kva—2300—230/115

NEW or USED

All types and sizes

Atlantic Transformer Co.
Transformer Specialties
5143 N. 2nd St., Philadelphia, Pa.

FOR SALE

New and guaranteed used steel pipe in large quantities up to 36" inclusive, also, new and guaranteed used boiler tubing, steel buildings, steel and wood tanks, valves, fittings and pumps.

Jos. Greenspon's Son Pipe Corp.
NATIONAL STOCK YARDS
St. Clair County, Illinois

STEAM PUMPING ENGINES

1—Snow 8MGD C&FW cr. Com. Opp. Type Cond. 26x54x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20x40x14¾x36 with waterworks type con.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. All find cond.
1—Worth Cr. Comp. Cr. & Fly wheel LDG Meyer Valve gear, 1 MGD, size 10/20x7½x18.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago 10, Ill.

BRONZE IRON **PUMPS** ALLOY METALS
ELECTRIC—STEAM—GASOLINE DRIVEN.
All Makes — Capacities — Pressures.
Centrifugal — Rotary — Plunger — Turbine.

MOTORS 1-2-3 PH. & D. C.
STANDARD EQUIPMENT — UP TO 200 H.P.
Generators — Welders — Dynamos.
New & Rebuilt Guaranteed Machines.

TURBO BLOWERS
SPENCER—INGERSOLL RAND—ALLEN BILLMYRE. For Heat Treating — Brazing Furnaces — Smelting — Vacuum Duty Etc.

TURBINE PUMP
BOILER FEED
VERTICAL ENGINE
VACUUM RETURN
STEAM UNITS

AIR COMPRESSORS
ALL TYPES—CAPACITIES 1 to 1000 "CFM"
Electric—Gasoline—Steam Driven.
For Industrial—Mine Construction.

VACUUM UNITS
FOR STEAM — AIR — GAS — FLUIDS.
All Makes—All Capacities—Tested.

FANS—EXHAUSTERS
CAPACITIES FROM 25 to 100000 CFM.
VENTILATING — SUCTION — BLOWING
Air—Dust—Gases—Steam Vapors.

MACHINERY
CHEMICAL & INDUSTRIAL EQUIPMENT.
ELECTRIC MIXERS—PORTABLE & STATIONARY.

SUPERIOR EQUIPMENT CO.
138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

SPECIALS
1—160 HP, 180#, Code, W. T. Boiler
1—100 HP, Code, Economic Type Boiler
1—82,000 Gallon Tank on 100' Tower
1—250 & 600 HP Slip Ring Motors
1—100 & 150 KVA Gens. D/C Chuse Engs.
25—1/3 HP Single Phase Motors—New
1—25 Ton Gas Locomotive Crane

H. & P. MACHINERY CO.,
6719 Etzel Ave., St. Louis 14, Mo.

MURRAY BOILER

300 HP Single long drum straight tube 180#, 180° superheat. Code. Full trim, Diamond soot blower. Crane nonreturn valve. Copes regulator. Taylor underfeed stoker. Offer at bargain.

F. W. HAY & COMPANY
2734 Cherry St. Kansas City 8, Mo.

200, 140, 125, 100 KW AC UNIFLOW SETS
200, 50 KW DC UNIFLOW SETS
Turbo, Water Wheel gen. sets, boilers
150 ton Ice Machine, Uniflow drive
1500 HP Cochrane Lea V open heater
80, 60, 25, 15 HP DC 115V. motors
60 HP Ideal 3/60-440 V. 720 RPM SC.
M.G. Sets, Transformers, pumps etc.

JAS. K. HOOPER
50 CHURCH ST., New York City 7

MOTORS AND PUMPS

4—Spencer PS-25 Class L Thermo-Exhauster with 3 HP Westinghouse motors attached 440 V, 1800 RPM, AC, 3 PH.
8—Spencer M1H Class H Thermo-Exhausters with 30 HP Westinghouse motors attached 440 V, 3 PH., AC.
12—Fairbanks Morse Pumps with 25 HP Fairbanks Morse motors attached 440 V, 3 PH., AC
4—Vickers V134 LH Pumps with Westinghouse 20 HP motors attached 440 V, AC, 3 PH.

VALVES

104—Oil Gauges
120—Butterfly Air Valves
80—240-02 Sensitrol Oil Valves
8—Automatic Switch Co. ¾ x ¾ type PNVA
4—Leeds and Northup Valve Motors
16—Hydraulic, 4-way, double selenoid operating valves
8—Logansport ¼" x 1¼" valves
20—W.S. Rockwell—Blast Gates 2", 6", 5" and 8"
8—Connelly "H" valves 2½" & 2"
4—No. 11 Regulators 3"
8—North American Air Valves 6"
48—Marshalltown 2½" diaphragm Gates

BURNERS

92—North American Oil Burner #210
8—North American Duel Fuel Burners #220
52—North American OIL-Air Ratiotrols
8—Wheel Co. Flame Eyes

This is offered subject to prior sale.

CONDENSER SERVICE & ENGINEERING CO., Inc.

95 River Street, Hoboken, N. J.

THE GLOW ELECTRIC COMPANY

933-943 HARRIET ST. Phone MA. 3024 CINCINNATI 3, OHIO

Solicits your inquiries for

AC & DC MOTORS
—GENERATORS
SYNCHRONOUS MOTORS
MOTOR-GENERATOR SETS
ELECTRIC HOISTS
STEAM ENGINE-GEN. SETS
SLIP RING MOTORS
PLATING GENERATORS
PUMPS
SPEED REDUCERS

IN EXCESS OF 12,000 ITEMS ARE AVAILABLE, TOO NUMEROUS TO LIST

WE BUY SURPLUS ELECTRIC EQUIPMENT

YOUR SPECIAL ATTENTION IS CALLED TO:—

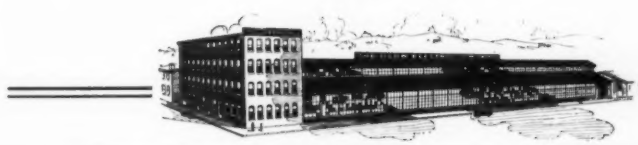
ROTARY CONVERTERS

Two General Electric, type HCC, 1700 KW, 514 RPM, 250 volts, d.c., 6 phase, 60 cycle, 6800 amps.
One General Electric, type HCC, 1100 KW, 250 volts, d.c., 6 phase, 60 cycle, 720 RPM, 4600 amps.

FYNN-WEICHSEL—(WAGNER)—SYNCHRONOUS TYPE

H.P.	RPM	H.P.	RPM
7½	1200	20	1200
10	1800	25	1800
10	1200	30	900
15	1800	30	900

IN BUSINESS SINCE 1905



VALVES

INDUSTRIAL & MARINE

METROPOLITAN PLUMBING SUPPLY CO., INC.

Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals. Jenkins, Fairbanks, Sarco, Powell Valves and surplus.

Large Complete Stocks ⅛" to 24"

313 E. 31st., NEW YORK CITY

For Hourly Nationwide Shipments Call MUrray Hill 3-3406

SKETCH PIPE & FITTINGS

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

—EXPORT— ***SPECIALS*** **—EXPORT—**

450 & 600 lb. Modern Boilers & Accessories
450 & 600 lb. Turbo-Generators, Non-Cond.
450 & 600 lb. Turb.-Gens. Cond., Bleed Type

2—770 HP B&W Co., Stirling 200# Boilers, Superheat—Reconditioned.
1—612 HP B&W Co. Stirling 200# Boilers—Ready to Ship
2—1400 HP B&W Co. Cross Drum 225#Boilers—Superheaters.
Various Makes, Boilers 150 to 2000 HP.
Turbo-Generators 100 KW to 22500 KW—Condensing & Non Cond.

CHARLES B. REARICK **30 CHURCH ST.** **NEW YORK**

FOR SALE

625 KVA — .80-FF—500-KW GE steam turbine driving GE generator—3600-RPM—240 volts — 3-PH — 60-Cy complete with field and exciter rheostats, surface condenser and Edwards steam-driven air pump. 125 pounds steam—28 inches vacuum.

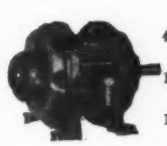
Can be seen in operation.

Available about October 1

ROOM 522

88 Broad Street Boston 10, Mass.

POWER EQUIPMENT COMPANY



OIL—AIR CIRCUIT BREAKERS

4—500 A GE FK 12 3 PST 15,000 V. Handle. Trip Coils and Currents.
1—800 A Conduit E4 600 V. 3 PST Handle. Trip Coils and Currents.
1—1200 A. GE FK 132 A 3 PST 7500 Handle with Trip Coils and Current Transformer.
1—2000 A GE CK 3 Air Breaker 3 PST 600 V. O. I. & U.V.
1—3000 A GE FK 25 Oil Breaker 3 PST 600 V. Solenoid operated with currents.

Sq. Cage—220/440 V. 60 Cy. 3 ph.

Qu.	HP	Make	Type	Speed
2	50	G.E.	KT-327	1800
2	100	G.E.	IK	1800
1	150	West.	CS	1800

Slip Ring—220/440 V. 60 Cy. 3 ph.

1	40	West	CW	720
1	50	G.E.	I-M	900
1	60	G.E.	I-M	900
1	75	West.	CW	900
1	250	West.	CW	1200

D. C. Variable Speed 230 V.

1	15	West.	SK	400/1600
1	25	West.	SK	440/1200
1	50	West.	SK	500/1500
1	50	G.E.	CD	400/1600

SEVERAL HUNDRED OTHER ITEMS IN STOCK
ABOVE ONLY SPECIALS—ALL REBUILT—STOCK SHIPMENTS

154 ANDREWS ST. **Tel. MAin 568 or 569** **ROCHESTER 4, N. Y.**

THESE AND OTHERS AVAILABLE FROM STOCK

NEW MOTORS

Squirrel Cage—3 Phase, 60 Cycle

Qu.	H.P.	Volts	R.P.M
4	1	220/440	3450
2	1½	220/440	3450
3	2	220/440	3450

Reconditioned & Guaranteed MOTORS

Squirrel Cage—3 Phase, 60 Cycle

Qu.	H.P.	Make	Volts	R.P.M.
2	25/19	G.E.	440	1200/1900
1	20	Lincoln	220	1800
1	25	Imperial	440	900
2	30	Al. Ch.	440	900
1	35	Al. Ch.	440	720
2	40	West.	220	720
1	40	Imperial	440	900
1	50	Burke	2200	900
2	50	Al. Ch.	440	1800
1	100	Al. Ch.	550	900
1	100	West.	220	600
1	150	Al. Ch.	440	1750

Slip Ring—3 Phase, 60 Cycle

Qu.	H.P.	Make	Volts	R.P.M.
1	15	Imperial	440	1150
1	15	Triumph	440	860
1	25	West.	440	1150

Synchronous

Qu.	H.P.	Make	Volts	R.P.M.
1	50	Ideal	2200	600
1	150	Al. Ch.	240	277
1	150	El. Mchy.	220/440	1200

D.C. Adjustable Speed

75—From 1 to 150 H.P., 230 and 115 volts.

Misc. Electrical Equipment

10—Reconditioned Lincoln Welders, 200 Amp., 230 volts, 3 phase, 60 cycle.

15—New Harnischfeger Electric Hoists, ⅛ to 2 ton capacity, 220/440 volts, 3 phase, 60 cycle.

ELECTRIC MOTOR & REPAIR CO.
Division of A-C Supply Co.
1745 FRONT ST. CUYAHOGA FALLS, OHIO

TRANSFORMERS
BOUGHT and SOLD

● We have always available a complete range of HI-GRADE rebuilt transformers. All units are carefully tested in accordance with A.I.E.E. specifications and carry a one year guarantee.

All work is done by the same organization and under the same rigid controls as the nationally known Gregory HI-GRADE line of new transformers.

GREGORY ELECTRIC COMPANY
2539 SO. STATE ST. CHICAGO 16, ILLINOIS

187 K.V.A. ENG. SET.

480 V. 60 cy. 3 ph. 225 Rev. GE. Eng. 18"x21" 4 Valve, Exciter Etc.

ROSS POWER EQUIP. CO. Indianapolis Ind.

— BOILERS —

9—Brand new 200 lbs. to 450 lbs. Combustion Engineering Boilers. Generates up to 44,436 lbs. steam per hr. actual. With oil burners and modern automatic features.

4—400 HP, B&W 187 lbs. Longitudinal Drum Boilers with structural and Dutch oven frame work, bricking and valves.

2—Modern 400 lbs. Code Watertube Boilers. Evaporation rate up to 33,462 lbs. per hr. with valves and fittings. Like new.

2—150 HP 125 lbs. Scotch Marine Double Furnace Boilers—retubed.

1—125 HP, 175 lbs. Wash. Iron Works Vertical Extended Firebox Boiler.

1—65 HP Lidgerwood 200 lbs. Code Vertical Round Boiler.

Subject to prior sale

Sundfelt Equipment Company
3422 First Ave. South, Seattle 4, Wash.
MAin 1474

FOR SALE
POWER PLANT & GENERATOR

Complete Power Plant including Steam Generator, Turbine 780 KVA, A.D. Generator, 2300 volt, 60 cycle, 3 phase, complete with voltage regulator and instrument panel, Condenser, Pumps, etc.—Good as new.

STOKERS

Also for sale—Two Westinghouse Stokers, Single Retort, 60" x 6'-½". These Stokers were purchased in 1940. Never used.

EDGAR BROTHERS COMPANY
McIntyre, Ga.

FOR SALE

5 CL-MS Worthington all bronze Centrifugal pump, 5 stage—600 G.P.M. 850' head. Driven by 100 HP Steam Turbine, has never been in service. Performance chart available.

VALVE & SUPPLY CO.
378 BEDFORD AVENUE
BROOKLYN 11, N. Y.

"SEARCHLIGHT" is *Opportunity Advertising . . .*

1—to help you find what you want.

2—to help you sell what you no longer need.

For every business want THINK "SEARCHLIGHT" FIRST

FOR SALE
ILLINOIS FORCED DRAFT STOKER
SIZE 10' x 15'

Complete with motor, Reeves drive and all other necessary equipment.

This unit is in perfect condition and is for sale at a bargain price.

EMPIRE BOX CORPORATION
GARFIELD, NEW JERSEY

Diesel Generator

180 horsepower, Fairbanks-Morse direct connected, 2,300 volt alternator, 150 K.V.A. Direct connected exciter, 7.5 K.W., in good condition. $4500.00.

FAYETTE
WATER, LIGHT & POWER DEPT.
117 South Main Street
Fayette, Missouri

E.M. GENERATOR — Synchronous — KVA 62.5, K.W. 50, 240 Volts, 3-phase, 60 cycle, 1200 RPM. d.c. to CUMMINS Diesel 6 cyl. (rated 150 H.P. at 1800 RPM) complete with Panel board, batteries.

Like new. Bargain $3000.00.

M. WENZEL
2136 Jefferson Kansas City, Mo.

BOILER

250-hp Babcock-Wilcox horizontal water tube boiler, 42 inches x 11 feet 6 inches, riveted steel drum; 130 three-inch tubes; 150-lb. working pressure. Fully equipped with Riley-Jones type S.P. side-dump hopper feed stoker, low water control and draft gauge. Installation includes 100-foot steel stack, 36-inches in diameter car-to-bin and bin-to-stoker conveyors as well as all necessary electrical equipment for complete operation.

All in excellent working condition. Having installed gas-oil boilers, we will sell as-is, where-is, at attractive price.

SHOPPING NEWS
5309 Hamilton Ave., Cleveland 14, Ohio

For Sale **1000 KW 250V-D.C. ENGINE GENERATOR SET**
FS-155, Power
230 West 42nd St., New York 18, N. Y.

BENJAMIN

NEW • ELECTRIC • STEAM • AIR EQUIPMENT
Thousands of Items A/C or D/C from 1 to 500 K.W.

WIRE, MAIL, or PHONE Your Requirements

USED EQUIPMENT Thoroughly Overhauled, Tested & Approved AND GUARANTEED for 1 full year

Agents for:
CROCKER-WHEELER
U. S. ELECTRIC TOOL CO.
WESTINGHOUSE AIR BRAKE
"SCHRAMM" and others

BENJAMIN RELYABILT EQUIPMENT

Benjamin's for Motors

ESTABLISHED 1904

130 CLINTON STREET ★ BROOKLYN, N. Y. WIndsor 5-1700

Thousands of Items - A/C or D/C. From 1 to 500 KW

FOR SALE

TURBINE GENERATOR

Steam Terry, Type C-2, Serial #19031, 500 KW, Steam Pressure 175 lbs. back pressure 18 lbs. 1800 RPM with lubricating oil pump for force lubrication to governor and throttle control.

GLAZER STEEL CORP.
610 Chamberlain St. Knoxville, Tenn.
Phone 3-0738

FOR SALE

STEAM ENGINE

450 HP Ridgeway Steam Engine with Alternator and Exciter. Offered where is and as is.

BLAIR VENEER COMPANY
North Troy, Vermont

OVERHEAD CRANES

1-Ton
Whiting 33' Span
Curtis 24' Span
1½-Ton
Shepard Niles 25'9" Span
P&H 34' Span
2-Ton
Louden 19'2" Span
Box 36'9" Span
Detroit 28' Span
3-Ton
Shaw 33' Span
P&H 25' Span
Northern 22' Span
Manning, Maxwell & Moore 48'¾"
"Conco" 48' and 26'6" Spans
5-Ton
Whiting 47'4" Span
38'10½" Span D. C.
Northern 30'9" Span
Milwaukee 70' Span
Milwaukee 66'9" Span
Manning, Maxwell, & Moore 70' Span
Manning, Maxwell, & Moore 47'4" Span
Shaw 36' Span
Champion 37'6" Span
American 70' Span
American 47'4" Span
6-Ton
P&H 77' Span
American 77' Span
7½-Ton
Shepard 36' Span
10-Ton
Shaw 68' Span
Shaw 73' Span
P&H 30' Span
P&H 87'6" Span
P&H 80' Span
Northern 71'10½" Span
Northern 60' Span
Morgan 55'6" Span
Morgan 39'5" Span
Morgan 52'3" Span
Milwaukee 66'9" Span
McGill 85' Span
Lane 50' Span
Ensco 75' Span
Dominion 35' Span
Cleveland 38'½" Span
Cleveland 50' Span
Alliance 71'10½" Span
Alliance 58'9" Span
Albany 60' Span
15-Ton
Whiting 71'10½" Span
Northern 53' Span
Erie 60' Span
Chesapeake 55'6" Span
Case 51' Span
20-Ton
Shepard Niles 49'6" Span
P&H 51'4" Span
Northern 60' Span
Morgan 60' Span
Cleveland 65' Span
25-Ton
Whiting 106' Span
Tysaman 60' Span
P&H 79' Span
Morgan 52'3" Span
Cleveland 106' Span
Case 63' Span
Bedford 50' Span
30-Ton
Whiting 80' Span
P&H 80' Span
P&H 60' Span
Morgan 30' Span
Case 41' Span
35-Ton
Bedford 50' Span
Northern 22' Span
50-Ton
Shaw 85' Span
Shaw 69'10" Span
Dominion 80' Span
Cleveland 71'10½" Span
75-Ton
Morgan 59'2½" Span
Alliance 78' Span
Alliance 37' Span
80-Ton American 40'8" Span
125-Ton Morgan 100' Span
150-Ton Whiting 30' Span
175-Ton Morgan 54' Span
200-Ton Alliance 100' Span

Telephone us collect to discuss your requirements.

ECONOMY CO., Inc.
49 Vanderbilt Avenue, New York 17, N. Y.
Telephones: MUrrayhill 4-2294, 4-2893, 4-2295, 4-2844, 4-2296, 4-3292

AUTOMATIC COAL BURNERS

FOR SALE

We have two Model 3 Iron Fireman Automatic Coal Burners for sale that we used for only one season. We purchased them new in 1943 for $2750 each. Reason for selling is we have converted to oil heat. These stokers burn a mixed grade of nut size low volatile Redlands and Dawson coal with an ash content of approximately 6%. Will sell at reasonable price, f.o.b., Philadelphia. Call or write

H. J. BECK
WESTINGHOUSE ELECTRIC CORPORATION
3001 Walnut Street Phila. 4, Pa.

200 KW GENERATOR SETS 100 KW

GENERAL MOTORS DIESEL ENGINES
8 Cylinder Model 8-268A
6½" Bore x 7" Stroke
Direct Connected to
200 K.W. WESTINGHOUSE ALTERNATORS
3 Phase, 60 Cycle, 440 Volt. Inc. Switchboards. BUILT 1943

3 Cylinder GENERAL MOTORS DIESEL ENGINE SETS:
Direct Connected to
100 K.W. CENTURY ALTERNATORS
3 Ph., 60 Cy., 440 Volt. Inc. Switchboards

LATEST MODEL IMMEDIATE SHIPMENT

ALJON ELECTRIC DIESEL CO.
904 Pacific Street Sterling 3-6515 Brooklyn 16, N. Y.

FOR SALE

BOILER—BURNER—PUMP

1—ALMY Type HA Water Tube Test Boiler 600# Operating Pressure, complete with #0 Gravity Type Ray Oil Burner and 6x2x6 Warren Horizontal Duplex Piston Steam Pump.

No reasonable offer rejected.

ADDRESS
BATH IRON WORKS CORP.
BATH, MAINE

MOTOR GENERATOR SET

1—200 KW 250 volt Compound Wound 1200 RPM direct connected to 1 - 288 HP 3 phase 60 cycle, 440 volts, 1200 RPM synchronous motor Allis Chalmers .8 P.F. 3 bearing, mounted on a common factory built base complete with AC and DC switchboard with auto transformer for automatic start.

Wire Orders Immediately.

THE MOTOR POWER CO. OF NEW YORK, INC.
859 Madison Avenue, New York 21, N. Y.
RHinelander 4-6478

SEARCHLIGHT SECTION

FOR SALE!

750 SIMPLIFIED ARC WELDERS

About 2 Yrs. Old—EXCELLENT CONDITION

IMMEDIATE DELIVERY

300 AMP. AND 400 AMP., 220-440 VOLTS. MFGRS: HOBART, G. E., LINCOLN, WESTINGHOUSE, (STANDARD MODELS).

50,000 ft. NEW WELDING CABLE

. . . and a large quantity of good used welding cable.

50,000 LBS. NEW ELECTRODES

(In original containers) MILD STEEL, HIGH TENSILE ALLOY AND CHROME NICKLE. ASSTD. LENGTHS AND DIAMETERS. TYPE: SURWELD, FLEETWELD AND STAINFELD.

SPOT WELDING TIPS

A large quantity, assorted.
For details and inspection, write, wire, phone

P. F. LOWINGER & CO.
90 WEST BROADWAY, N. Y. 7
REctor 2-3990

FOR SALE

SURPLUS EQUIPMENT

One 28" x 36" Hamilton Uniflow Engine direct connected to G. E. 900 KW, .8PF, 150 RPM, 2300 Volt, 3 Phase, 60 Cycle Generator. This is a complete unit now installed in our plant.

For complete description and prices wire, telephone or write

FARLEY & LOETSCHER MFG. CO.
Dubuque, Iowa

FOR SALE

STOKER

Jones C. H. Hydraulic drive stoker 5 HP, 3 phase, 60 cycle, 550 volt motor operating fan and stoker. Width of grate or retort 4'6", length 6' 4½" maximum capacity 265 H.P. Used only one season.

REED-PRENTICE CORPORATION
Worcester 4, Mass.

FOR SALE

3—Used 10 KVA single phase transformers, voltage 6600/110/220, GE Form G.

CARSTENS BROS
Luverne, Minn.

FOR SALE

15—New Stearns #1006B, type DS, Magnetic Disc brakes, 135 max. torque ft. lbs. continuous duty for 440 volt service, waterproofed, all for floor or foot mountings, New, Immediate delivery.

STEWART BOLLING & COMPANY, INC.
3190 E. 65th St., Cleveland 4, Ohio

WANTED

ALTERNATOR—1800 RPM

300 - 500 KVA

Condition of winding unimportant

KENTUCKY EDISON CO.
STANTON, KY.

Cash Ready

FOR YOUR

ELECTRICAL EQUIPMENT

Electric motors, AC and DC
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment

Send us list with full details

WIRE OR PHONE
P. O. Box 534

POWER EQUIPMENT CO.
154 ANDREWS ST. ROCHESTER 4, N. Y.
Telephone Main 568 or 569

WANTED

2—300 H.P. Boilers with stokers in exexchange for

2—600 H.P. Springfield Crossdrum Boilers complete with Harrington stokers, including steel structure, soot blowers, superheaters, forced draft fan and vertical reciprocating steam engine 8x8. Approved for 200# working pressure. Completely dismantled ready for immediate shipment.

MIDWEST MFG. COMPANY
Galesburg, Illinois

WANTED

1000 k.w. Condensing Turbine,

3 phase, 60 cycle, 3600 r.p.m., direct connected exciter, complete with condenser pump and auxiliaries, interconnecting pipes, switchboard and instruments. Specify all details as to age, length of service, and submit drawings.

SECURITY MILLS, INC.
Box B
Newton 58, Mass.

Air Compressors Wanted

STATIONARY—100 CFM AND UP
PORTABLES—2 STAGE
Ingersoll and Worthington Only

L. W. BAUER
North Bergen, N. J.

WANTED

1—1000 K.W.—1200 RPM A.C. GENERATOR

P. O. Box 232
Port Washington, L. I., N. Y.

WANTED TO BUY

One (1) 125 HP. Boiler and Stack. Must pass insurance for 150 pound working pressure.

CRYSTAL ICE WORKS, INC.
P. O. Box 98 Bartow, Fla.

WANTED

DIESEL GENERATOR SET

1 Diesel Generator Set complete. 300-350 k.w. 60 cycle, 240 volt, 3 phase, slow speed, heavy duty preferred. Specify complete details. No dealers.

SECURITY MILLS, Inc.
Box B, Newton 58, Mass.

WANTED

CATALOGS

General Catalogs of Westinghouse Co. years 1923—1924 and 1933 to 1938 inclusive. Also General Electric Co., from 1922 to 1929 inclusive.

W-157, Power
330 West 42nd St., New York 18, N. Y.

WANTED

MOTOR GENERATOR SET

75 or 100 K.W.
220 V. A.C. to 220 V. D.C.
WRITE, WIRE OR PHONE
R. L. CONGO
REGENSTEINER CORPORATION
310 South Racine Avenue
Chicago, 7, Illinois

MACHINERY WANTED

200 KW—40 RPM AC GENERATOR
Engine Type
MR. JACK—BOX 232
Port Washington, L. I., N. Y.

WANTED

ELECTRIC GENERATOR

10 or 15 K.W. Steam driven Electric Generator 220 Volt-3 Phase-60 Cycle—125# Steam. Must be new or in A-1 condition.

CRYSTAL ICE WORKS, INC.
Bartow, Fla.

WANTED TO BUY

Complete paper mill or paper making machinery for immediate delivery. What have you to offer for immediate inspection.

A. C. ASKEW
Box 3073 Whittier Station, Tulsa 8, Okla.
Phone 6-6120

WANTED

Two D.C. MOTORS

TYPE MPC, CLASS 6—150 H.P. 500. Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

W-973, Power
330 West 42nd St., New York 18, N. Y.

---

500 or 600 K.V.A.

DIESEL DRIVEN GENERATOR

3 Phase, 60 Cycle.
Give details, age and Price.

W-158, Power
520 North Michigan Ave, Chicago 11, Ill.

BERGER OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGERS SETS
ALL SIZES, VOLTAGE AND CYCLES

MOTOR GENERATOR SETS
ALTERNATORS ALL FREQUENCIES
TRANSFORMERS LARGE STOCK
D. C. GENERATORS ALL VOLTAGES
CONTROL EQUIPMENT

3 ph. 60 cy. A. C. Motors
3 ph. 25 cy. Motors
125 Volt D. C. Motors
230 Volt D. C. Motors
550 Volt D. C. Motors

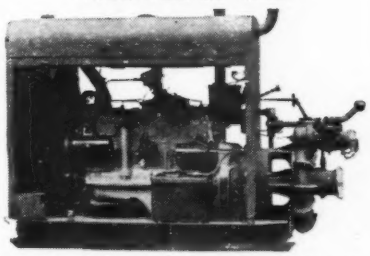
WRITE OR WIRE YOUR INQUIRIES

BERGER BROTHERS Electric Motors, Inc., 395 STATE ST., ROCHESTER 4, NEW YORK
PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION.

HIGH PRESSURE ALL PURPOSE

PUMP

PRACTICALLY NEW



Big heavy duty Chrysler gasoline Engine driven centrifugal pump. 500 G. P. M. at 120 lbs. pressure or 250 G. P. M. at 200 lbs pressure. Equipped with self starter—skid mounted—self priming. Rugged unit ideal for water supply—fire fighting—booster service! *Same unit also comes mounted on 2 wheel Pneumatic-tired, spring-mounted carry-all trailer with ball and socket towbar, rear reflectors and parking brakes. Net weight approximately 2100 lbs. 11 foot 7 inches long x 79 inches wide x 70 inches high.*

Also Available FRONT MOUNT PUMP
It can be mounted on '38, '39, '41 Fords; '38, '39 Chev.; and '40 Intl. trucks. Complete with adapter bracket and accessories.
Write or Phone for Further Information

KADCO CORPORATION
DEPT. P
36-38 11th St. L. I. C., N. Y.
IRonsides 6-8604

1—18" x 21" Chuse non-releasing Corliss engine, 125 to 135#, 5 to 7# back pressure, serial close to 1300 series, direct connected to

1—180 KVA, 150 KW, 80% P.F. type TRE, form D-36, 3-phase, 60 cycle, 220 volt no load, 200 RPM Western Electric alternating current generator equipped with

1—8 KW, 64 amperes, 125 volt, type ML, frame F, 1050 RPM General Electric exciter complete with

1—Switchboard panel and instruments

Offered at $4800.00 f.o.b. Georgia shipping point.

PORTER ELECTRIC COMPANY, INC.

330 South Sixth Street Minneapolis 15, Minn.
GEneva 8655

WURTH for "WORTH"!

A.C. GENERATORS 3 PHASE—1 PHASE 15 TO 62½ KVA

LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P
D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS
Send For Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY
Motors, Generators, Alternators, Frequency Changers
141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

FOR SALE

2 FREDERICK STOKERS

850 lb. HD Hopper Feed, Side Dump Stokers. Used only one season—in perfect condition. Also, overhead monorail conveyor with 2 dump cars and electric hoists. Please inspect and submit reasonable offer.

RAYMOND R. BEATTY, INC.
30 Garth Road Scarsdale, N. Y.

For Immediate Delivery

1—680 KW NORDBERG UNAFLOW
Engine Generator Set

Left hand, non-condensing, full Poppet valve engine: General Electric 3/60/440, Generator: Belted 30 KW exciter. Complete and in Perfect Condition.

WIRE — WRITE — PHONE
Send for Printed Circular
Newberry Manufacturing Co.
P. O. Box 295 Newberry, Michigan
Telephone Newberry 16

FOR SALE

2—15 ton Erie O.H.T. Cranes. 60' span. Built in 1942. Excellent condition.

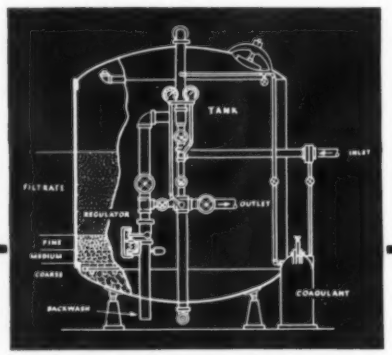
For further particulars wire or phone

GLAZER STEEL CORPORATION
610 Chamberlain St. Phone 3-0738
Knoxville, Tenn.

GOVERNMENT-OWNED SURPLUS

WATER SOFTENERS

Small communities, plants, laundries and others who have been forced by war conditions to delay purchase of water softening equipment may now get the needed units in a hurry and at low cost. Over $1,000,000 worth of this equipment has been declared surplus and is ready for delivery. This equipment, much of it unused, was built to rigid government specifications for use in Army and Navy installations all over the world. The units and accessories are suitable for installations which would normally call for expenditures from $1000 to $70,000 — but in this instance the cost of the equipment will average considerably under normal expenditures. To purchase this equipment, simply call your nearest W.A.A. Regional Office or mail the coupon below.



HOW TO BUY

1. Determine engineering requirements set up by your specific needs.

2. If you are a veteran obtain your priority certificate from the W.A.A. priority certification office in your area. (Check W.A.A. Regional Office for addresses of such offices).

3. Contact W.A.A. office (by phone or letter) nearest you and request aid in locating the specific kind and type of equipment you need. Prices and terms of sale can be quickly arranged.

FREE INFORMATION:

To War Assets Administration:

I am interested in water softening equipment and accessories for an installation capable of handling.....gals. per minute. Without obligation, please send me pertinent information.

Name.....Telephone No.....

Firm.....

Address.....

City.....State.....

554

WAR ASSETS ADMINISTRATION

OFFICES LOCATED AT: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cleveland • Dallas Denver • Detroit • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles Louisville • Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco Seattle • Spokane • Cincinnati • Fort Worth

FOR SALE!

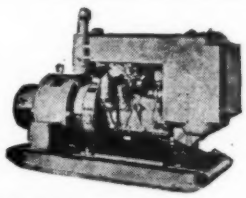
750 SIMPLIFIED ARC WELDERS. About 2 Years Old—Excellent Condition—Immediate Delivery. 300 Amp. and 400 Amp., 220-440 Volt. Mfgrs: Hobart, General Electric, Lincoln, Westinghouse. Standard Models.

50,000 Ft. NEW (and a large quantity of good used) WELDING CABLE.

50,000 Lbs. NEW (in original containers) ELECTRODES—mild steel, high tensile alloy and chrome nickle. Assorted lengths and diameters. Type: Surweld, Fleetweld and Stainfeld.

For details and inspection write—wire—phone

P. F. LOWINGER & COMPANY
90 WEST BROADWAY, N. Y. 7
REctor 2-3990



THE BUY OF A LIFETIME

NEW 25 KW-Continental generator

230-3-60, directly connected to International Harvester Diesel engine. Complete switchboard with auto-regulator and spare parts.

Export packed.

Also many other sets in stock from 300 Watts up.

SPRAYED INSULATION, INC.
78 Hawthorne Place, Montclair, New Jersey
Montclair 2-6121-2

1—Standard 48 inch TRACTION TYPE Hydraulic Coupling as manufactured by American Blower Co. This coupling is good for 1000 Hp. at 600 rpm. Has been completely refitted with new bearings and seal rings and is in perfect condition.

For full information and price address—

S. D. DORNBIRER, Agent
P. O. Box 668 Rutland, Vermont

FOR SALE

1 Hamilton-Corliss Engine #3066, 16x30 E. Right Hand, 110 lbs. initial steam pressure. Atmospheric exhaust, 110 R.P.M., 180 I.H.P. at 25% cut off, 25 lbs. steam per I.H.P. hour. Good condition.

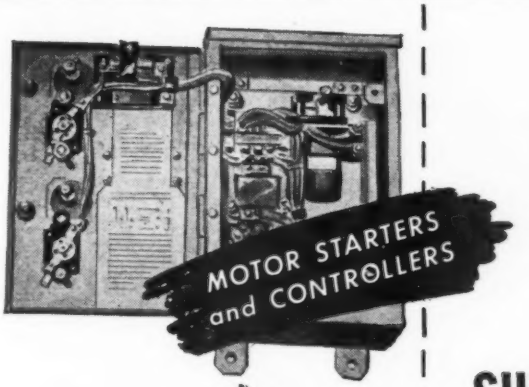
THE WRENN PAPER COMPANY
Middletown, Ohio

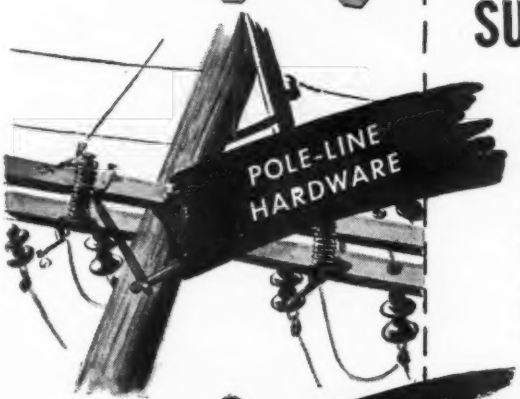
DETROIT STOKER

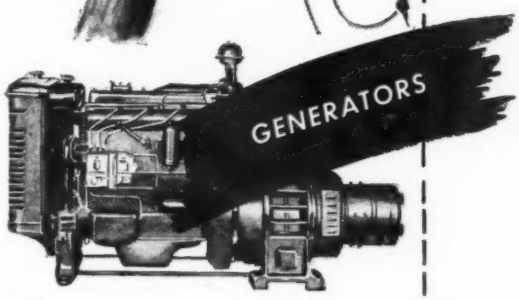
FOR SALE

Double retort, complete with controls, fan, motors, etc. 8'-6" to 9'-9" wide, by 6'-6" deep. Will produce 600 B.H.P., continuously. Used two heating seasons. In first class condition. Being replaced by oil burners. Address:

J. S. TOPP
c/o Georgetown University, Washington, D. C.







AVAILABLE NOW!

AT REDUCED PRICES

SURPLUS ELECTRICAL EQUIPMENT

Electrical equipment and material in large quantities are now available in many locations throughout the country. Complete information may be obtained from the nearest Regional Office of the War Assets Administration.

Included in this war surplus inventory are hundreds of items of standard and special equipment—pole-line hardware, wire and cable, motors, switch gear, wiring devices, power-conversion and sub-station equipment. The special items in many cases can be adapted or converted to your needs. *Priced to sell*, these items will help solve the electrical supply problems of manufacturers, industrial contractors, wholesalers and dealers—investigate today.

1 **MOTOR STARTERS AND CONTROLLERS** — General Electric, Westinghouse, Cutler-Hammer, Ward Leonard and other makes, built to both commercial and Navy specifications. 115 and 230 volt d-c; 220 and 440 volt a-c., 60-cycle, 3 phase, drip proof, waterproof, manual and magnetic types. Unused and used. Substantial savings.

2 **Pole-Line HARDWARE**—Insulators, pins and nearly all other items of pole line hardware for transmission, distribution and communications lines. Well-known makes, meeting exacting Government specifications, new, in excellent condition.

3 **GENERATORS**—Engine driven, 100 kw., single bearing, 120/240 volt d-c., 1200 rpm. commercial and industrial types. Unused and in good condition. Many other sizes—gasoline, diesel, steam and electrically driven, and generators without prime movers, a-c and d-c. Check our large lists.

4 **Graphite and Carbon BRUSHES**—Large quantities of new brushes of well-known makes, in a wide range of sizes, in both standard and special types for motors, generators and other rotating electrical machinery.

Although this material has been previously offered to priority claimants 10% of the merchandise has been reserved to fill any further needs of priority claimants, including Veterans of World War II, who are invited to contact the Regional Office serving their Area with respect to this material.

(CUT OUT AND SEND TO THE NEAREST WAA OFFICE LISTED BELOW)

War Assets Administration: I am interested in the following checked items:

WIRE & CABLE	WIRING DEVICES
GENERATORS	POWER-CONVERSION EQUIPMENT
SWITCH GEAR*	SUB-STATION EQUIPMENT
SPECIAL ELECTRIC MOTORS	PROTECTIVE EQUIPMENT

Name ..... Tel. No. .....

Firm .....

Address .....

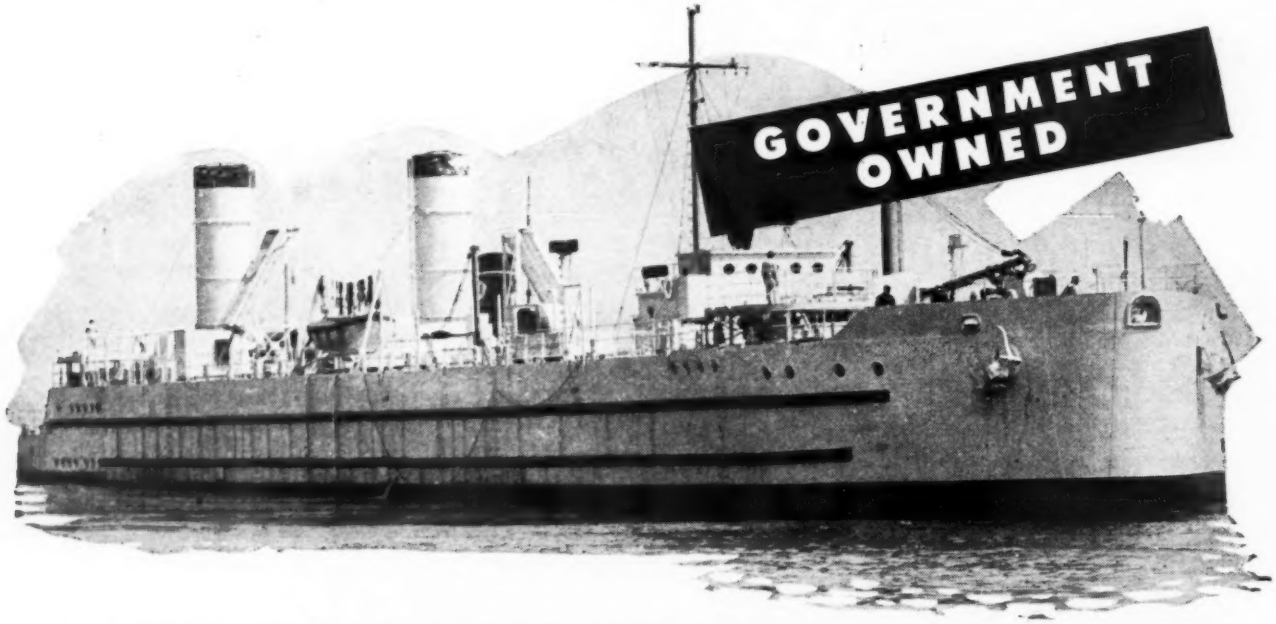
City ..... State .....

319-3

EXPORTERS: Most surplus property is available to the export market. Merchandise in short supply is withheld from export and if such items appear in this advertisement, they will be so identified by an asterisk.

WAR ASSETS ADMINISTRATION

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles Louisville • Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane



FLOATING POWER PLANT "RESISTANCE"

For Sale

GOVERNMENT OWNED SURPLUS PLANTS

The War Assets Administration invites proposals for the purchase of this floating, steam-electric power plant, constructed for War Emergency use and now declared surplus to the needs of the War Department. Philadelphia, Pennsylvania (Plancor 525).

Contained in an ALL-WELDED SEA GOING HULL, suitable for towing from one location to another, this modern high-pressure, high temperature Power Plant is designed to operate at either 50 or 60 cycles, and at an efficiency comparable to a modern high-pressure stationary power plant.

With a 50 foot beam, 358 foot length, 9½ foot draft, and 28 foot height with smoke stacks and transmission towers removed, the dimensions of the Hull permit passage through locks of standard size and under low bridges on inland waterways. Seven days fuel oil storage, based on operation at full capacity, is provided for.

MACHINERY AND EQUIPMENT include: Turbo-Generator: General Electric, 3 phase, 13.8 KV, 3,600 RPM, 19 stage, 825 psi gauge, 900° F, with capacity of 30,000 kw at 60 cycles and .8 power factor, or 25,000 kw at 50 cycles and .9 power factor. Equipped with Elliot condensers using either salt or fresh water.

Boilers: 2—Babcock and Wilcox, 170,000 lbs. per hour each, at 835 psi gauge, and 910° F. Equipped to burn fuel oil or natural gas.

Auxiliary Power Units: 2—300 kw Diesel engine generator sets, 480 volts AC, 3 phase, 60 cycles. Ingersoll Rand engines and General Electric generators.

Substation: Westinghouse 37,500 KVA, 13.8 KV transformer with taps for 132—126—120—112—109—69 and 63 KV.

CREDIT TERMS MAY BE ARRANGED FOR THE PURCHASE OF THIS PLANT

All data contained herein are necessarily abbreviated, and subject to correction. They are not intended for use as a basis for negotiation. For more complete information contact the office indicated below. WAR ASSETS ADMINISTRATION reserves the unqualified right to reject any or all proposals or offers received for the above property.

Address your inquiries or proposals to:

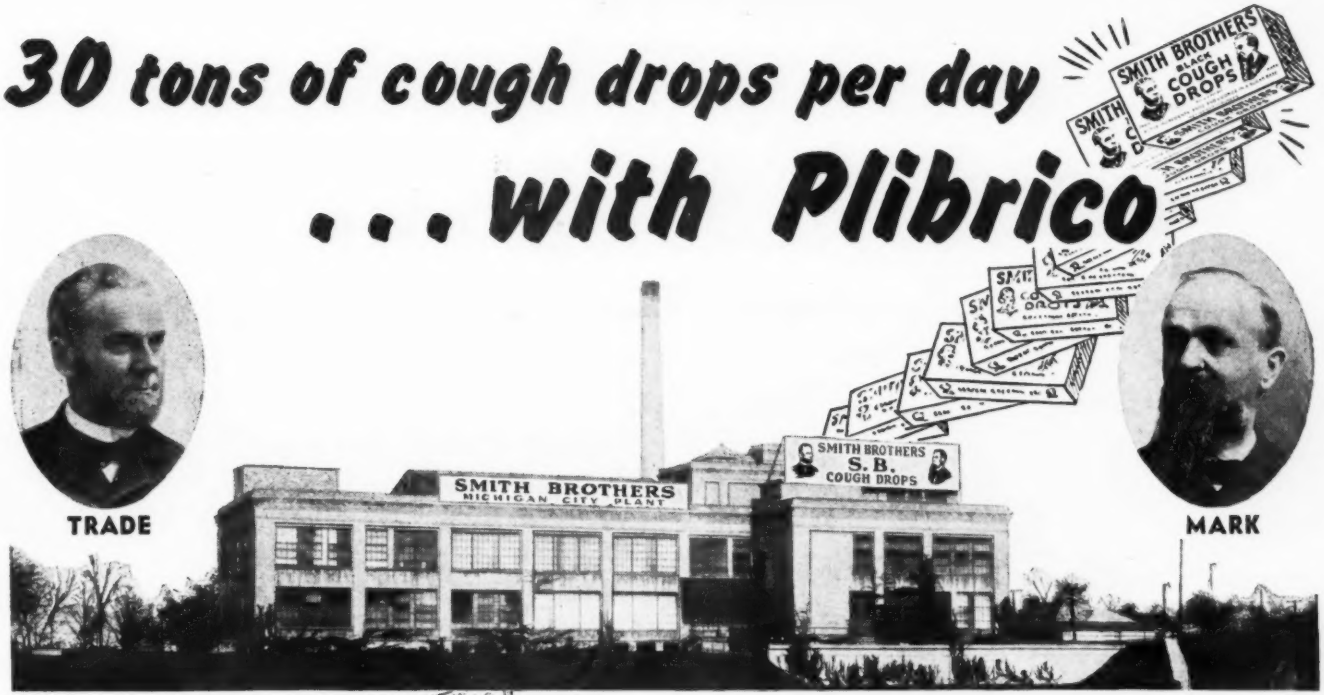
Utilities Branch—Industrial Division
OFFICE OF REAL PROPERTY DISPOSAL

WAR ASSETS ADMINISTRATION

WASHINGTON 25, D. C.
PHONE: REPUBLIC 7500, EXTENSION 3664

604T

30 tons of cough drops per day ...with Plibrico



Plant No. 2 of Smith Brothers, Inc., Michigan City, Ind.

TO most people those bearded Smith Brothers on the familiar cough drop package have become almost as allegorical as Jack Frost or Father Time. The fact remains, however, that the famous brothers were real human beings. "Trade" was William Smith and "Mark" was Andrew Smith—sons of James Smith, who started the making of cough drops 'way back in 1847 in the kitchen of his restaurant in Poughkeepsie, New York.

The Smith Brothers made good cough drops. They relieved coughs and they tasted good. Their fame spread and the business grew rapidly. The bearded faces became, as they are today, among the best known trade-marks of their time. The business is still truly a Smith Brothers business. A. G. Smith, son of "Trade" operated it until his death in 1936. Now A. G. Smith's two sons, William and Robert, head Smith Brothers, Inc.

Today Smith Brothers products are manufactured in two modern factories at Michigan City, Ind., and Poughkeepsie, N. Y. The Michigan City plant with a capacity of thirty tons of cough drops per day is equipped with two 150 hp. H.R.T. boilers. Plibrico Jointless Firebrick has been used for furnace repairs since 1926. When Iron Fireman pneumatic spreader stokers were installed at the Michigan City plant in 1944, the furnaces were completely relined with Plibrico.

The present condition of the Plibrico linings at the Michigan City plant is shown by the recent photograph opposite (Boiler No. 1). The photo tells the familiar story of Plibrico's ability to do the job right and stand up in service—a story almost as well known as the famous countenances of "Trade" and "Mark".

Both boilers at Smith Brothers plant in Michigan City are equipped with complete Plibrico linings which are giving excellent service.

PLIBRICO Sales & Service engineers in more than 100 cities in the United States and Canada provide complete installation and boiler setting service, or your own maintenance men can install Plibrico. Ask for catalog, specifying H.R.T. or water-tube edition.

PLIBRICO JOINTLESS FIREBRICK CO., 1818 Kingsbury St., (Dept. H), Chicago 14, Ill.

Plibrico Jointless Firebrick, Ltd., New Toronto, Ont.

PLIBRICO *Jointless* FIREBRICK

ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues.

Adams Co., R. P. 259
Airetool Mfg. Co. 290
Air Preheater Corp. *
Air Transport Ass'n of America for Railway Express Agency 162
Ajax Flexible Coupling Co. *
Alco Products Div. *
Allen-Sherman-Hoff Co. 2nd Cover
Allis-Chalmers Mfg. Co. 12, 42, 46, 47, 157
Alloy Steel Products Co. 223
Allpax Co. 212
American Blower Corp. 305
American Brass Co. 125
American Chain & Cable Co. 297
American Chimney Corp. 302
American Coal Burner Co. 294
American District Steam Co. 150
American Engineering Co. 19, 211
American Locomotive Co. *
American Manganese Steel Div. 164
American Metal Hose Branch *
American Radiator & Std Sanitary Corp. 305
American Pulverizer Co. 195
American Sand-Banum Co. 220
Ames Iron Works *
Anaconda Wire & Cable Co. 203
Anchor Packing Co. 177
Anderson Co., V. D. 143
Ansul Chemical Co., Fire Extinguisher Div. *
Arkansas Fuel Oil Co. 197
Armstrong Cork Co. 243
Armstrong Machine Works 115
Asbestos, Textile & Packing Div. Raybestos Manhattan, Inc. *
Atlas Valve Co. 214
Automatic Control Co. *

Babbitt Steam Specialty Co. 216
Babcock & Wilcox Co. 4-5
Babcock & Wilcox Tube Co. 249
Bacharach Industrial Instrument Co. 286
Badenhausen, Inc., J. Phillips 212
Badger & Sons, E. B. *
Bailey Meter Co. 10-11
Baldwin-Hill Co. *
Bartlett Hayward Div (Koppers Co.) *
Bartlett & Snow Co., C. O. 282
Bates & Co., Walter 296
Beaumont-Birch Co. 176
Belco Ind. Equip. Div. *
Belmont Packing & Rubber Co. *
Bernitz Furnace Appliance Co. 274
Betz & Co., W. H. & L. D. *
Biddle Co., James G. 166
Bird-Archer Co. 299
Black, Sivalls & Bryson *
Blaw-Knox Co. 49
Boiler Tube Co. of America 288
Bonney Forge & Tool Works 237
Boston Woven Hose & Rubber Co. 253
Botfield Refractories Co. 220
Bowser, Inc. *
Brickseal Refractory Co. *
Bridgeport Brass Co. *
Brooke Engineering Co. 190
Brownell Co. 294
Brown Instrument Co. 289
Brunt Equipment Co. 302
Buell Engineering Co. *
Buffalo Forge Co. 283
Buffalo Pumps, Inc. 53
Bull Dog Electric Products Co. 263
Burke Electric Co. 252
Burlington Instrument Co. 294
Bussmann Mfg. Co. *
Byers Co., A. M. 62
Byron Jackson Co. *

Cabot, Inc., Samuel 216
Canton Stoker Corp. *
Carborundum Co. 281
Cardox Corp. 271
Cash Co., A. W. 48
Cash Valve Mfg. Corp., A. W. 286
Chapman Valve Mfg. Co. 141
Chase Brass & Copper Co. *
Chicago Metal Hose Corp. 218
Chicago Pneumatic Tool Co. 236
Cities Service Oil Co. 197
Clarage Fan Co. 260
Clark Mfg. Co. 285
Cleaver-Brooks Co. 222
Coats Machine Tool Co. *
Cochrane Corp. 216, 303
Coffin, Jr. Co., J. S. 256
Combustion Control Corp. *
Combustion Engineering Co. 20-21
Cooper-Bessemer Corp. *
Coppus Engineering Corp. 245
Corning Glass Works 186
Crane Co. 127
Cryer Trap & Valve Co. 192
Cuno Engineering Co. 215
Cutler-Hammer, Inc. Back Cover
Cyclotherm Corp. 264

Dampney Co. of America 57
Dart Mfg. Co., E. M. 160
Daugherty Co., Inc. 148
Davis Engrg. Co. *
Davis Regulator Co. 174
Dayton Rubber & Mfg. Co. *
Dearborn Chemical Co. 275
De Laval Separator Co. 226
De Laval Steam Turbine Co. 58, 200
Deming Co. 240
Detroit Stoker Co. *
Diamond Power Specialty Corp. 8-9
Dixon Crucible Co., Joseph *
Dodge Mfg. Corp. 234
Dollinger Corp. *
Dominion Chemical Co. 306
Dowell, Inc. 269
Drew & Co., E. F. *
Dudgeon, Inc., Richard 198

Eagle Mfg. Co. *
Eagle-Picher Sales Co. 266
Edward Valves, Inc. 121
Electric Fish Screen Co. *
Electric Machinery Mfg. Co. *
Electric Storage Battery Co. 232
Electro Metallurgical Co. 209
Elgin Softener Corp. 217
Elliott Co. 6-7
Engineer Co. *
Everlasting Valve Co. 292

Faber Engineering Co. *
Fairbanks Co. *
Fairfield Engineering Co. 123
Fairmont Coal Bureau *
Fischer & Porter Co. 212
Flexitallic Gasket Co. *
Flexo Supply Co. *
Flexrock Co. 302
Flynn & Emrich Co. *
Foster Engineering Co. 262
Foster Wheeler Corp. 13, 35
Foxboro Co. 163
France Packing Co. 194
Frick Co. 180
Fuller Co. 168
Fyr-Feeder Spreader Stoker 294

Gardner-Denver Co. *
Garlock Packing Co. 201
General Am. Transportation Corp. *
General Cable Corp. *
General Coal Co. 178
General Electric Co. (Apparatus Dept) 26-27, 34, 37, 41, 147, 183
General Electric Co. (Appliance & Merchandise Dept) *
Gifford-Wood Co. 205
Globe Steel Tubes Co. *
Goetze Gasket & Packing Co. 257
Golden-Anderson Valve Specialty Co. 250
Goodyear Tire & Rubber Co. 17
Goulds Pumps, Inc. *
Graver Tank & Mfg Co. *
Graybar Electric Co. 225
Green Fuel Economizer Co. *
Greene, Tweed & Co. 247
Grinnell Co. 3rd Cover
Griscom-Russell Co. 251

Gulf Oil Corp. *
Gulf Refining Co. *

Hagan Corp. 24-25
Haering & Co., Inc., D. W. 214
Hahn Equipment Corp. 298
Hall Laboratories 50-51
Haynes Stellite Co. *
Hays Institute of Combustion 184
Heacon, Inc. *
Hendrick Mfg. Co. 220
Hendy Iron Works, Joshua 140, 229
Henszey Co. 172
Hercules Float Works 200
Hill Pump Valve Co. *
Hoffman Combustion Engrg Co. *
Hoffman Specialty Co. 208
Homestead Valve Mfg. Co. 295
Hoppes Mfg. Co. 292

Ideal Industries, Inc. 290
Infilco, Inc. *
Ingersoll-Rand Co. 40
Inland Steel Co. 300
International Cementers, Inc. *
International Nickel Co. 36
Iron Fireman Mfg. Co. *

Jefferson Union Co. 180
Jeffrey Mfg. Co. 227
Jenkins Bros. 132-133
Johns-Manville, Inc. 137
Johnson Service Co. *
Jones & Laughlin Steel Corp. 280
Jones Foundry & Machine Co., W. A. *
Joy Mfg. Co. (La-Del Div) 273
Joy Mfg. Co. (Sullivan Div) *

Keasbey & Mattison Co. 88
Kellogg Co., M. W. 170
Kennedy Valve Mfg. Co. 254
Kennedy-Van Saun Mfg. & Engrg Corp. 22-23
Kewanee Boiler Corp. 186
Kieley & Mueller, Inc. 270
Koppers Co. *

Ladish Drop Forge Co. 169
Laminated Shim Co. 196
Leeds & Northrup Co. *
Leslie Co. 244
Lincoln Electric Co. *
Linde Air Products Co. *
Link-Belt Co. 3
Liquidometer Corp. 292
Locke Regulator Co. *
Lubriplate Div. Fiske Bros. Refining Co. *
Ludlow Valve Mfg. Co. 176
Lummus Co. 279
Lumnite Div, Univ. Atlas Cement Co. 187
Lunkenheimer Co. 44-45

MacWhyte Co. 192
Manhattan Rubber Div., Raybestos-Manhattan, Inc. 255
Manheim Mfg. & Belting Co. 265
Manzel Brothers Co. *
Mark & Co., Clayton *
Marley Co. 242
Marsh Corp., James P. *
Mason-Neilan Regulator Co. *
Mc Alear Mfg. Co. 219
McGraw-Hill Book Co. 296, 300
Mercoid Corp. 210
Midwest Piping & Supply Co. 230
Minneapolis-Honeywell Regulator Co. *
Mitchell Co., W. R. *

Murray Iron Works 158

National Airoil Burner Co. ..... *
National Aluminate Corp. 131
National Tube Co. ..... *
National Valve & Mfg. Co. 278
Niagara Blower Co. ..... *
Nicholson and Co., W. H. 206
Nordberg Mfg. Co. 193
Northern Equipment Co. 135
Norton Co. ..... *
Nugent & Co., W. W. ..... *
Nutmeg Chemical Co. 206

Oakite Products Co. 210
Ohio Injector Co. ..... *
Orr & Sembower, Inc. 293
Otis Elevator Co. 246
Owens-Corning Fiberglas Corp. 233

Pacific Pumps, Inc. ..... *
Packless Metal Products Corp. 188
Parker Appliance Co. 261
Peabody Engineering Corp. ..... *
Peerless Pump Div. 286
Permutit Co. 200, 301
Persson Co., T. G. 212
Philadelphia Gear Works 238
Photoswitch Co. ..... *
Pipe Fabrication Institute 207
Pittsburgh Piping & Equipment Co. 145
Pilbrico Jointless Firebrick Co. 339
Powell Co., Wm. 54–55
Powers Regulator Co. 218, 302
Prat-Daniel Corp. ..... *
Preferred Utilities Mfg. Corp. 287
Pritchard & Co., J. F. ..... *
Proportioneers, Inc. ..... *

Q-P Mfg. Co. 276
Quaker Rubber Corp. ..... *

Raybestos-Manhattan, Inc. 253
Reading, Pratt & Cady Div. 297
Reliance Electric & Engrg. Co. 241
Reliance Gauge Column Co. 16
Republic Flow Meters Co. 14–15
Republic Rubber Div. (Lee Tire & Rubber Co.) ..... *
Republic Steel Corp. ..... *
Research Corp. 199
Resinous Products & Chemical Co. 235
Revere Copper & Brass, Inc. 129
Rhoads & Sons Co., J. E. 298
Richardson Scale Co. ..... *
Ric-Wil Co. ..... *
Ridge Tool Co. 167
Riley Stoker Corp. 96–97
Robins Conveyors, Inc. 165
Rockbestos Products Co. 159
Roebling's Sons Co., J. A. 268
Roper Corp., Geo D. ..... *
Ross Heater & Mfg. Co. ..... *
Roto Div. of Elliott Co. 228

Sarco Co. 277
Sauerman Bros. Inc. 198
Scherr Co., Geo. ..... *
Schramm, Inc. 146
Schutte & Koerting Co. 221
Scovill Mfg. Co. 191
Shaw Co., B. F. 173
Sier-Bath Gear Co. (Pump Div.) 213
Sinclair Refining Co. 52
Sivyer Steel Casting Co. 18
Skinner Engine Co. 248
Sloan Valve Co. 170
Smith Refractories, Sanford C. 302
Smooth-On Mfg. Co. 306
Socony-Vacuum Oil Co. ..... *
Springfield Boiler Co. 39
Square D Co. 181
Squires Co., C. E. 298
Standard Oil Co. of Calif. ..... *
Standard Oil Co. of Ind. 151–152
Standard Pressed Steel Co. 214
Steel & Tubes Div. ..... *
Stephens-Adamson Mfg. Co. 43
Sterling Engrg. & Mfg. Corp. 214
Stickle Steam Specialties Co. ..... *
Stock Engrg. Co. 202
Stomac Engineering Co. 204
Stone & Webster Engrg. Corp. 161
Strong, Carlisle & Hammond Co. 153
Sturtevant Co., B. F. ..... *
Sturtevant Mill Co. 144
Sun Oil Co. 119
Swartwout Co. 342
Syntron Co. 302

Taylor Co., W. A. ..... *
Taylor Forge & Pipe Works 267
Taylor Instrument Co's ..... *
Templeton Mfg. Co. 214
Terry Steam Turbine Co. 231
Texas Co. 32–33
Thermix Engineering Co. ..... *
Thermoid Rubber Div. ..... *
Tidewater Associated Oil Co. 171
Timken Roller Bearing Co. 175
Toledo Pipe Threading Machine Co. ..... *
Tripp Metallic Packing Co. 302
Troy Engine & Machine Co. 189
Tube Turns, Inc. 139

Union Carbide & Carbon Corp. 209
Union Chain & Mfg. Co. ..... *
Union Iron Works 284
U. S. Gauge Div., American Machine & Metals, Inc. 216
U. S. Rubber Co. 291
U. S. Steel Corp. 187

Viking Pump Co. ..... *
Vogt Machine Co., Henry 155

Waite Construction Co. ..... *
Wallace & Tiernan Products, Inc. ..... *
Walworth Co. 258
Warren Steam Pump Co. 272
Watson-Stillman Co. 224
Webster & Co., Warren ..... *
Western Chemical Co. 156
Westinghouse Electric Corp. 60–61
Weston Electrical Instrument Corp. ..... *
Wheeler Mfg. Co., C. H. 28–29
Where To Buy 302
Whitlock Mfg. Co. ..... *
Wickes Boiler Co. 185
Wiedeke Co., Gustav ..... *
Williams Gauge Co. 182
Wilson Inc., Thomas C. 239
Wing Mfg. Co., L. J. ..... *
Wrigley Jr. Co., Wm. 288

Xzit Sales Co. 184

Yarnall-Waring Co. 30–31, 117, 154
Youngstown Sheet & Tube Co. 56

Zernickow Co., O. 302

PROFESSIONAL SERVICES 304

SEARCHLIGHT SECTION

(Classified Advertising)

CLASSIFICATION	PAGE
EMPLOYMENT SERVICE	307
POSITIONS VACANT	307
POSITIONS WANTED	307
SELLING OPPORTUNITIES	307
WANTED TO PURCHASE	334
USED EQUIPMENT	307, 338

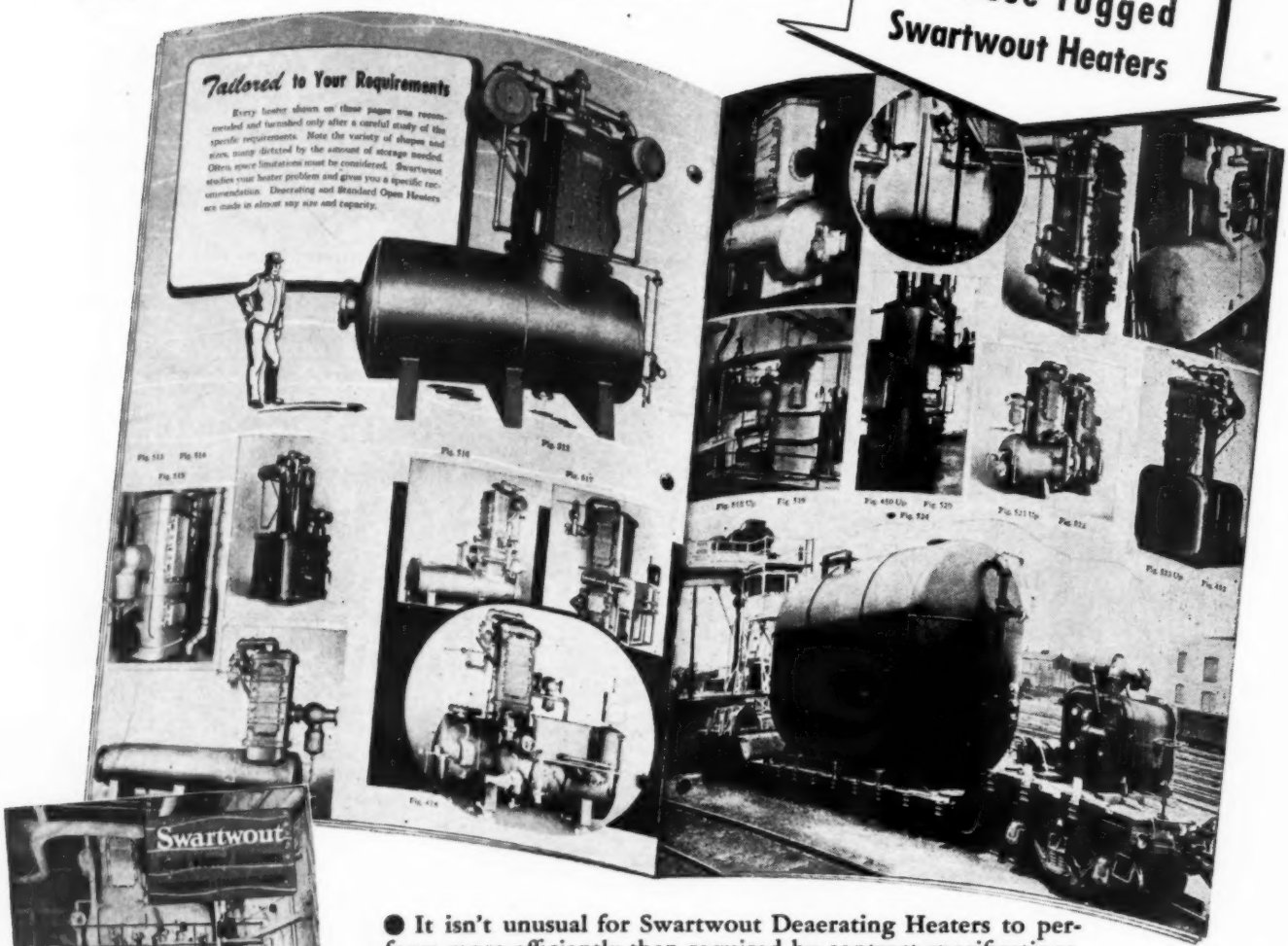
Andren-Myerson Corporation 329
Archer & Baldwin 328
Askew, A. C. 324, 334
Alion Elect Co. 330, 333
American Air Compressor Corp. 323
Arnessen Electric Co. 328
Atlantic Transformer Co. 330
Bauer, L. W. 334
Bath Iron Works Corporation 333
Beatty Inc., Raymond R. 335
Belyea Co., Inc. 311
Benjamin's For Motors 333
Berger Bros. Electric Motors, Inc. 335
Blair Veneer Company 333
Birch Manufacturing Co. 330
Brearley, H. P. 325
Brew, Wolfman & Co., Inc. 320
Carstens Brothers 334
Chicago Electric Co. 326
Crystal Ice Works, Inc. 334
Cohen Pump & Mchy Co. 329
Condenser Service & Engr. Co. Inc. 331
Davis Co., J. F. 320
Dornbirer, S. D. 336
Duquesne Electric & Mfg. Co. 327
Economy Co., Inc. 333
Edgar Brothers Company 332
Empire Box Corp. 332
Electric Apparatus Repair Co. 324
Electric Equipment Co. 323
Electric Generator & Motor Co. 320
Electric Motor & Repair Co. 332
Electric Service Co., Inc. 325
Ellis Co., A. Lee 322
Erie Electric Co., Inc. 326
Fayette Water, Light & Power Dept. 332
Farley & Loetscher Mfg. Co. 334
Fletcher Sales Co. 330
Glazer Steel Corp. 333, 335
Glow-Electric Co. 331
Greenspon's Son Pipe Corp., Jos. 330
Gregory Electric Co. 332
Hay & Co., F. W. 330
Hooper, Jas. K. I. 330
H. & P. Machinery Co. 330
Hall & Co., Stephen 328

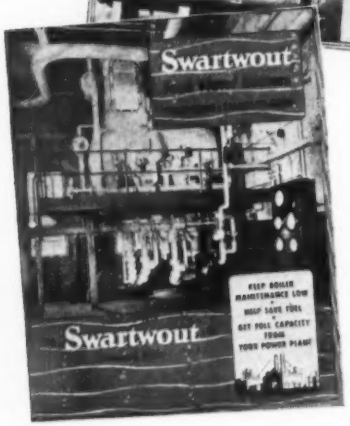
CLASSIFICATION	PAGE
Heat & Power Co.	316
Hemphill & Co. Inc., J. L.	309
Howe Brothers	324
International Power Machy. Co.	310
Jack, Mr.	334
Johnson & Asso., Howard Blaine	323
Kadco Corporation	335
Kentucky Edison Company	334
Keystone Power Plant Eq. Co.	323
Kiemie Co., Fred W.	329
Kirk Co., Wallace E.	322
Land & Co., L. J.	308
Locke, Co., C. B.	325
Lowinger & Co., P. F.	334, 336
Metropolitan Plumbing Supply Co., Inc.	324, 331
Mac Cabe Co. T. B.	327
Midwest Mfg. Co.	334
Mississippi Valley Equipment Co.	329
Motor Power Co., of N. Y. Inc.	333
Newberry Mfg. Co.	335
O'Brien Machinery Co.	319
Penn Machinery Co.	325
Porter Electric Co., Inc.	335
Power Equipment Co.	331, 334
Power Plant Equipment Co., Inc.	328
Rearick, Charles B.	331
Reed-Prentice Corporation	334
Regensteiner Corporation	334
Republic Textile Equipment Co.	320
Ross Power Eq. Co.	332
Sampson Machinery & Supply Co.	318
Schoonmaker, A. G.	312, 313, 317, 322
Schoonmaker, Robert	329
Security Mills, Inc.	334
Shopping News	332
Sprayed Insulation Inc.	336
Stanhope, Inch., R. C.	323
Stewart Bolling & Co. Inc.	334
Stewart & Co., Inc., Paul	325
Sundfelt Equipment Co.	332
Superior Equipment Co.	330
Tampa Armature Works Inc.	321
Topp, J. S.	336
Thompson Parker Co., J.	323
Utilities Electric Machinery Co.	315
Valve & Supply Co.	332
Wagner Co., Arthur	322
War Assets Administration	336, 337, 338
Wente Electric Co.	314
Weaver & Co., Charles	324
Wenzel, M.	332
Westinghouse Electric Corp.	333
Wrenn Paper Co., The	336
Wurth Electric Motor Co.	335

Swartwout Feed Water Heaters

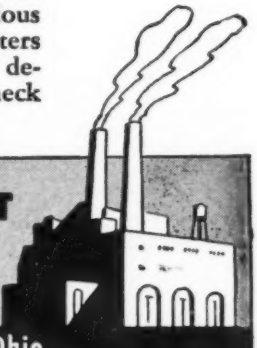
make unusual records every day in hundreds of power plants

Your problem can be met with one of many styles of these rugged Swartwout Heaters


Tailored to Your Requirements
Every heater shown on these pages was recommended and furnished only after a careful study of the specific requirements. Note the variety of shapes and sizes, many dictated by the amount of storage needed. Often, space limitations must be considered. Swartwout studies your heater problem and gives you a specific recommendation. Deaerating and Standard Open Heaters are made in almost any size and capacity.



● It isn't unusual for Swartwout Deaerating Heaters to perform more efficiently than required by contract specifications. Dependability is built into them. Faithfully and economically they guarantee the necessary preheating capacity and oxygen removal needed for your boilers, and go *beyond* the actual performance required of them. This assured capacity means less outage, consistent fuel economy, and elimination of much of the costly boiler cleaning and energy-killing corrosion. Various types and sizes—each engineered to fit its job—these heaters are built to standard time-tried Swartwout principles of design. Write for new Heater Bulletin S-18-E and plan to check with your consulting engineer about Swartwout Heaters.



Swartwout POWER PLANT EQUIPMENT

THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio

GRINNELL

PIPING PROGRESS

Steam Header — 18" O.D. x 7/8" wall, 13' 8 3/8" long. Carbon-Moly Turned and Bored Forging with solid, integral end-closure. One 12", three 10" and one 6" outlets.

Extruded Headers

Question: **How can headers be made with smooth inside contours, minimum friction to flow and requiring only plain circumferential butt welds . . . and still comply with Code requirements?**

Answer: **By the extruded nozzle process which permits the making of any number of any size outlets.**

Grinnell Extruded Nozzles are made by a patented hydraulic forming process. Outlets can be extruded up to and including full size. Inside contours are smooth, assuring minimum friction to flow. Welding ends are machined to same wall thickness as abutting pipe. Only circumferential butt welds are required.

WHENEVER PIPING IS INVOLVED

Typical of Grinnell's advanced pipe fabrication facilities is this forming process for outlets in headers which simplifies erection of piping on the job by elminating difficult intersection type welds. They are made possible by this company's 95 years of piping experience and continuous laboratory research and experimentation.

Whenever piping is involved–Grinnell has the specialized knowledge, field engineering experience and the production facilities to handle the job from first plan to actual operation. From this one source you can get everything from a tiny tube fitting to a complete power or process piping installation.

GRINNELL COMPANY, INC., Executive Offices, Providence 1, R. I. Branch warehouses in principal cities. Manufacturing Plants: Providence, R. I.; Cranston, R. I.; Atlanta, Ga.; Warren, Ohio; Columbia, Pa.

GRINNELL

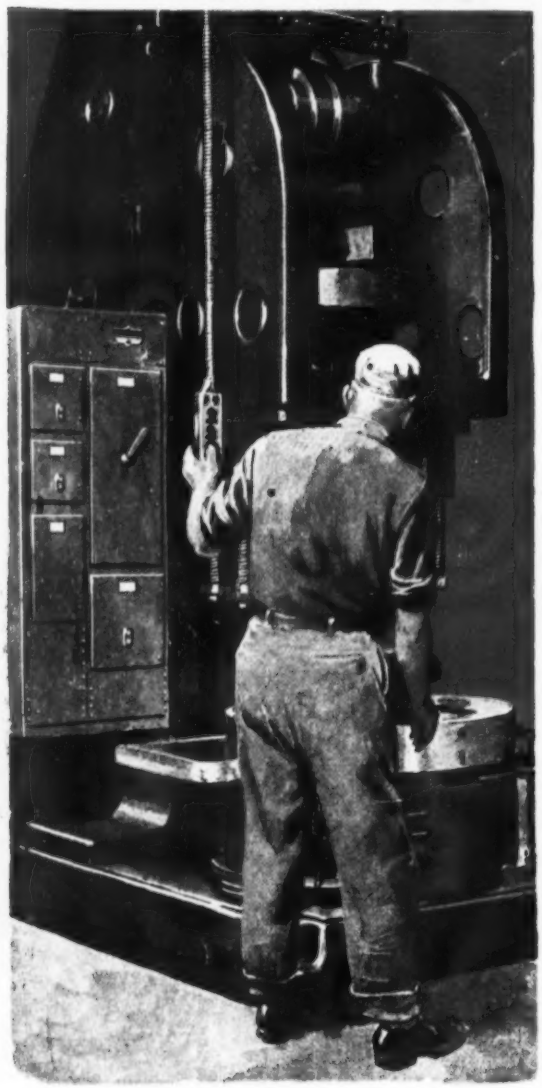
FOUNDED 19-

WHENEVER PIPING IS INVOLVED

The modern system of control

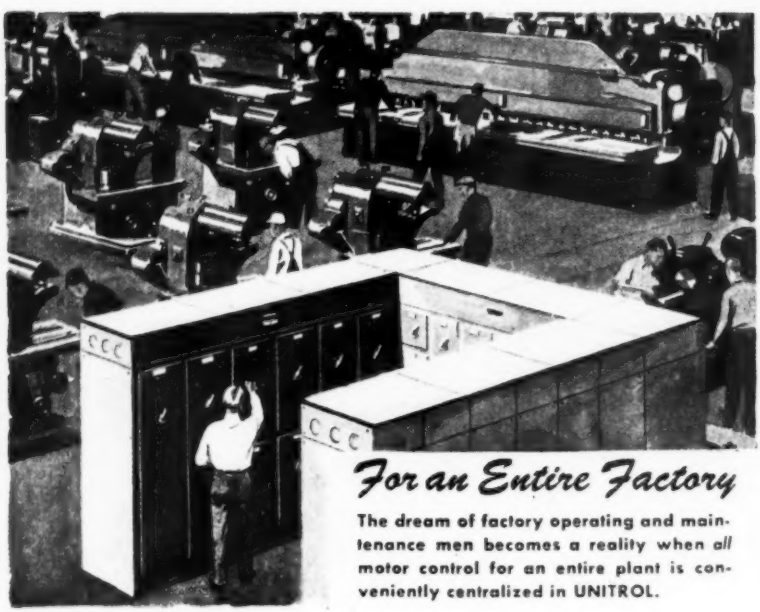
For a Single Machine

UNITROL allows the orderly assembly of all control equipment for a single machine into an out-of-the-way, yet very accessible unit.



For One Department

Many additional gains are made when the control equipment for all the machines in one department is organized in a single UNITROL installation.



For an Entire Factory

The dream of factory operating and maintenance men becomes a reality when *all* motor control for an entire plant is conveniently centralized in UNITROL.

Of the many engineering advances pioneered by Cutler-Hammer, the standardized flexible control center has undoubtedly provided the solution to more long-standing problems of factory layout, efficient operation, and proper electrical maintenance than any other motor control development. UNITROL permits the economical, safe, and convenient consolidation of control equipment to simplify machine installations and provide uncluttered space for machine operators and workmen. More than that, UNITROL simplifies the whole task of installing and mounting motor control, eliminating any need for costly wall or floor preparation or special construction. When progress calls for replacement of individual controls, rearrangement or relocation of control equipment, UNITROL permits these changes to be easily made. Continuing benefits are gained from UNITROL's close grouping of control elements hitherto widely scattered throughout a plant . . . and inspection is more convenient, safe, more regular, more certain to be made. For these and other savings in space, in time, in money, in labor, today, tomorrow and throughout the future, experienced factory managers insist on Cutler-Hammer UNITROL, industry's most modern motor control.

CUTLER-HAMMER
UNITROL
C-H

UNITROL • TRADE MARK REG. U. S. PAT. OFF.

CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto